Carleton University

COMP 4905 – Honours Project

Cross-Platform Ordino

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Abstract

In COMP 3004, some peers and I created a student organization application called Ordino for Android devices. That application had two shortcomings. First, anyone without an android phone would not be able to use it. Second, the data was stored locally and could only be accessed on that device. To solve these problems, I created a cross-platform desktop version of the application that allows users to access their data on multiple devices. I accomplished this using the Electron.js framework, with Ember.js as the backend, and the Firebase real-time cloud database service to store data. Using Ember.js instead of Express.js simplified the development of the web application. Through Electron.js, the application is operating system agnostic and was easier to develop and deploy than a typical Java application.

Acknowledgements

I acknowledge that I did not use any copyrighted material to make my application. However, my application makes use of numerous Ember addons which provide helpers and components. These addons are released under an MIT license. To help with styling the application I used Bootstrap. Some addons, such as *ember-electron*, provide blueprints which I used to set up initial configurations before tweaking them to meet my needs. All other code, I hereby acknowledge, as being written solely by myself.

1. Introduction

Prior to the creation of Node.js, which I will refer to as Node from here on, JavaScript was solely used as the predominant client-side scripting language [Nel, 2014]. Node has enabled JavaScript to be used for developing highly scalable, asynchronous web servers [Nel, 2014]. Node has also unified the use of JavaScript on the client-side and server-side. The popularity of Node has grown since its release, with many large companies, such as Walmart [O'Dell, 2012] and Netflix [Xiao, 2014], converting their high traffic websites to Node web applications. Due to its popularity, numerous frameworks have been developed to ease the creation of Node web applications. Each of these Node frameworks have their own set of features and design methodologies. The COMP 2406 *Fundamentals of Web Applications* course at Carleton University teaches how to create Node web applications, including using one framework, Express.js.

While on a co-op work term, I was introduced to the Ember.js framework which I will refer to as Ember from here on. Ember is viewed as being a little snobby or opinionated, since there is usually only a single way to accomplish some piece of functionality [Erdi, 2017]. This is due to all the common idioms and best practices that developers are forced to use. However, it is rapidly gaining popularity because of how much the framework simplifies making a web application [Erdi, 2017]. Since there is usually only a single way to implement something, following the best practices becomes second nature which increases developer productivity [Erdi, 2017]. The slogan for Ember is *"A framework for creating ambitious web applications"* [Anon., 2017b]. With a lot of design and implementation decisions already made for the developer, it allows the developer to focus on building up the application functionality and focus on business logic [Erdi, 2017]. Many popular websites, such as Groupon [Druta, 2017] and DockYard [Dupuis, 2017], are Ember web applications.

Node was originally created for developing web servers. A few years ago, a framework was created to allow Node to be used in the development of desktop applications [Anon., 2017a]. This framework is presently named Electron.js which I will refer to as Electron from here on. Electron is developed by GitHub as the framework for their hackable text editor, Atom [Anon., 2017a]. Node is used to make the backend of the application, while Chromium is used to create the frontend application window [Anon., 2017a]. Since Node servers and Chromium can run on any operating system, Electron allows for the development of an operating system agnostic application from a single code base [Anon., 2017a]. In addition to Atom, Electron has been used to develop the Slack [Betts, 2016] and Microsoft Visual Studio Code [Bright, 2015] applications.

Since the creation of Node, JSON or NoSQL databases have become increasingly popular as the values returned by queries are already in JSON form. This unifies the data format used on the client-side, the server-side, and the web application's database. Firebase is a mobile application and web application platform that provides many services, such as a real-time database. The Firebase real-time database stores and retrieves data records as JSON objects [Anon., 2017d]. Through data synchronization, any changes to data are updated across all connected clients so that the current data is always being displayed [Anon., 2017d].

Ember, Electron, and Firebase are intriguing tools on their own, but I was curious on how well they would work together to create a complex, real-time cloud data, desktop application. In this report, I start by stating my motivation for undertaking this project. I then give a recap of the technologies we used in COMP 2406. I then go over the development of my project application, including the challenges I faced integrating Ember, Electron, and Firebase together. I follow this by comparing developing the Ember portion of the application to the technologies used in COMP 2406 and comparing developing an Ember and Electron desktop application to a conventional approach, such as using Java. I finish the report by suggesting further investigating that should be done with Electron and giving my conclusions.

2. Project Motivation

One of the hardest challenges of succeeding in school is staying organized and efficiently balancing all of your courses. In COMP 3004, a group of peers and I created a student organization application called Ordino for Android devices. That application had two shortcomings. First, anyone without an Android phone would not be able to use it. Second, the data was stored locally and could only be accessed on that device. Additionally, the data could not be backed-up and then restored on a new device. For this project, I set out to create a cross-platform desktop version of that application so that it could be installed on more devices and be connected to a cloud database so that a user could access their data on multiple devices simply by installing the application and logging in.

To accomplish this cross-platform cloud application, I wanted to use the Electron framework. I became intrigued by Electron when I learned it was used to develop Atom and Slack, two applications that I use regularly. As such, I was interested to find out how developing an Electron desktop application compared to my experiences developing a desktop application using a conventional language, such as Java. Furthermore, I wanted to use Ember as the backend Node framework of the desktop application and store data in the cloud using Firebase's real-time database service. Through preliminary research, I found no existing application that integrated Electron, Ember, and Firebase together into the application. All three technologies are very powerful on their own and if they could be used together, I believed that they could produce many complex applications. Thus, I decided on this project with the main goal of determining if Electron, Ember, and Firebase could be seamlessly integrated together to create a fully functioning and deployable desktop application. To demonstrate this, I decided I would be creating a cross-platform, desktop application version of Ordino.

3. Technologies Taught in COMP 2406

When I was enrolled in the COMP 2406 *Fundamentals of Web Applications* course, we were taught how to create web applications using Node. We learned how to use one Node framework named Express.js, which I will refer to as Express from here on. The development stack also included the Handlebars template engine and the MongoDB database. Express is a Node framework for creating minimalist web servers [Anon., 2017c]. This means that there are few features available in a newly created Express application, but there are many modules and middleware available as a developer needs them [Anon., 2017c]. With no unnecessary features within an Express application, they are able to achieve fast performance. This makes Express a viable replacement for Apache as a static file server.

In COMP 2406 we learned about dynamic page creation. Template engines can be integrated into Express. When I was enrolled in COMP 2406, we were given the choice of using Handlebars or Jade as the template engine for assignments. I chose to use Handlebars. Handlebars templates are written in HTML with embedded Handlebars expressions to display dynamic values. There are special Handlebars expressions called *block expressions* to help simplify tasks such as iterating. In addition to expressions, helpers can be used to perform operations while rendering the template. Figure 1 shows a simple example of a Handlebars template.

```
{{#each users}} <!-- block expression that displays the enclosed content for each item in users -->
  <div class='user-info'>
    <div class='name'>{{name}}</div>  <!-- expressions are between {{ }} -->
    <div class='age'>{{age}}</div>
    <div class='sum'>{{sum 1 2}}</div> <!-- helper named sum that adds 2 numbers -->
  </div>
{{/each}}
```

Fig. 1: Example Handlebars template

MongoDB is the database we learned about in COMP 2406 and is an example of a JSON or NoSQL database. MongoDB stores data as JSON-like objects so fields can vary between documents [Anon., 2017e]. This is very different from SQL databases where all objects of the same type (in the same table) have the exact same columns and each column for a row must have a value. The data is easily mapped to and from JSON objects, making it easy to use in Node applications as there is a common data format. With MongoDB, object fields can be indexed to improve the performance of queries [Anon. 2017e]. MongoDB is not a cloud database like the Firebase real-time database service, so the user data is stored locally on the host computer.

Using Express, Handlebars, and MongoDB allows for the creation of fast, minimal servers, with dynamic page creation, and data storage on the host machine. There are similarities and differences between these technologies and the technologies I used the develop my application. Express and Ember in particular are quite different Node frameworks, but they do have some common elements. These similarities and differences will become clear in the following sections of the report.

4. Making of the Application

As mentioned in section 2, my goal for this project was to determine if Electron, Ember, and Firebase could be seamlessly integrated together to create a cross-platform, cloud, desktop application. This was to be demonstrated by creating a cross-platform, desktop application version of Ordino, a student organization application I had developed for Android devices during a past school project. Typically, Electron applications are composed of a Node server as the backend of the application while Chromium is used to create the frontend application window [Anon., 2017a]. As such, I split this section into two parts. The first part discusses the making of the backend of the application using Ember and Firebase. The second part goes over the Electron specific tasks for launching the frontend window of the application and the tasks involved in deploying the application.

4.1. Creating the backend

The backend of an Electron application is typically a Node server, but it can just be a single HTML file. For the backend of my application, I decided to use the popular Node framework, Ember. As mentioned in section 1, Ember is a strongly opinionated, yet very powerful framework for creating complex web applications. This is achieved by forcing developers to use best practices and common idioms. The most basic building blocks that are part of a typical Ember application are routes, controllers, components, templates, and helpers.

A router defines all valid routes that can be navigated to within the application. Each defined route is responsible for rendering the appropriate template, loading model data, and setting up the application state for the current route. There can be nested routes defined in the router where the parent route is setup before the child route. A route can have a specific path name or use a *slug* to define dynamic path segments. In Figure 2, the router defines a nested route where the *song* route is a child route of the *songs* route. The *song_id* slug is used as the dynamic path segment for the *song* route. An example URL path to the *song* route would be */songs/1*.

```
Router.map(function () {
    this.route('songs', function () {
        this.route('song', { path: ':song_id' });
    });
});
```

Fig. 2: Example Ember router definition

Each route can have an associated controller, but can exist without one. However, a controller must be associated with only one route. Controllers only receive the data model that the route generated and can process it to produce properties to be rendered in the route's template. One of the main uses of controllers is to provide *actions* to the route template which can be thought of as user interface event handlers. If the model data does not need to be processed or no actions are needed, there is no need for a controller; the model data can be referenced directly in the route's template.

Ember applications automatically come with the Handlebars template engine integrated. Each route can have an associated template, but like controllers, can exist without one. However, a template must be associated with only one route. There is no error if there is no template for a route, either nothing will be displayed, or the parent route's template is displayed if a parent route exists. Associated routes, controllers, and templates must share the exact same filename and be in the appropriate folder. The files that are associated with a child route must be in a folder with the same name as the parent route. Ember instantiates routes and controllers automatically at runtime and thus, expects the corresponding files to be in a specific place. Figure 3 shows an example Ember application file tree where *song* is a child route of the *songs* route.

```
controllers/
    songs/
        song.js
    songs.js
routes/
    songs/
        song.js
    songs.js
templates/
    songs/
        song.hbs
    songs.hbs
```

Fig. 3: Example Ember application file tree

Helpers provide additional functionality to templates. Ember applications come with many special helpers when the application is initialized. For example, the *{{outlet}}* helper can be used to leave a place in a parent template to render the contents of child templates. This allows for the extraction of common pieces of the user interface into parent templates, while child templates provide the page specific pieces of the user interface. Helpers can also process data and return a result which is rendered in the template. These kinds of helpers are useful for tasks such as formatting date strings and rounding to a specified number of decimal places.

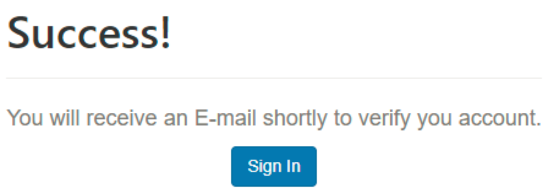
Components can be thought of as little bundles of user interface functionality that are separated from the application and have their own template and component controller. By convention, components are not supposed to have any idea about the state of the application. They are plugged into templates and are given the state information they need but should not communicate with the outside application. Commonly, event handlers or callback functions are passed to components so that the application can learn about the changes of state within the component. When components are isolated from the application, they can be reused in numerous applications.

In making the backend of the Electron application, I wanted to ensure all the building blocks I explained above were used in some way to show all the main features of Ember. I started by generating the skeleton Ember application using Ember CLI. Ember CLI is a command line tool for developing Ember applications. It is made by the makers of Ember and simplifies the development of Ember applications. It is the predominant tool for developing Ember applications [Erdi, 2017], even being a prerequisite to the introduction tutorial on the Ember website. Ember CLI can be used to generate application pieces, such as routes and controllers, and ensures they are placed in the correct folder. It also aids in dependency installation by adding new dependencies to the *package.json* file and automatically integrating Ember addon dependencies into the application. The tool can be used to launch the web application from the command line and it automatically hot-swaps code changes into the web application as they happen.

The first piece of functionality I decided to add to my application was integrating Firebase with the application for account authentication and storing user data. Firebase can be integrated with many development platforms, including web applications. The Firebase SDK is available as a single, compressed JavaScript file. Although it is possible to load in a JavaScript module into the global application namespace, this is not a common practice when developing Ember applications. Addons are the standard way to plugin functionality into Ember applications. Through research, I came across an open-source Ember addon named *emberfire*. *Emberfire* is an adapter for integrating Firebase with Ember. The adapter handles the mapping of the application's data records to and from the Firebase real-time database service. *Emberfire* also provides all the Firebase SDK functions, including the ones needed for authentication management. As hoped, the integration of Firebase with Ember went seamlessly. In the Ember application's *environment.js* configuration file, a Firebase entry had to be added with the Firebase project URL, ID, and API key included.

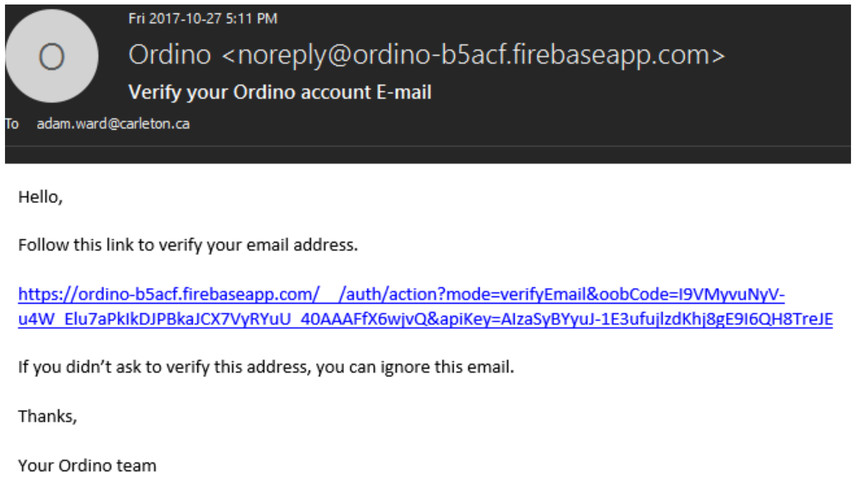
Ember Data is the library Ember ships with for managing data persistence. An adapter is needed to create a proxy for storing and retrieving data. *Emberfire* provides such an adapter to handle the storage and retrieval of data for the configured Firebase project. To use this adapter in my Ember application, I needed to create a data adapter for the application that extended the adapter provided by *emberfire*. *Emberfire* ensures the Ember Data records are kept in sync with the Firebase real-time database service, ensuring the displayed data is the same across all connected clients. Without refreshing the current page, the displayed data is automatically updated when a change to the data is made on another connected client as long as there is an Internet connection.

With the ability to communicate with Firebase, I began to implement the user authentication functionality. I started to create the sign up, sign in, and password reset pages. To accomplish this, I had my first exposure to Ember services which allow objects to be easily accessed from various parts of the application. A service is registered with a given name and then can be injected as a property based on the name of the service. A service can be injected in any route or controller and even in components, although this breaks the standard of components not being able to communicate with the application. Through reading documentation, I determined the name of the *Emberfire* service and injected it into the controllers of the routes and controllers that handled user authentication. The service provided all the functions in the Firebase SDK JavaScript file without polluting the global namespace. With access to these functions, I was then able to facilitate the creation of accounts (see Figure 4), verifying an account e-mail (see Figure 5), signing into a new account session, and resetting account passwords.


Success!

You will receive an E-mail shortly to verify you account.

Fig. 4: Successful creation of an account


Fri 2017-10-27 5:11 PM

Ordino <noreply@ordino-b5acf.firebaseapp.com>

Verify your Ordino account E-mail

To adam.ward@carleton.ca

Hello,

Follow this link to verify your email address.

https://ordino-b5acf.firebaseapp.com/__/auth/action?mode=verifyEmail&oobCode=I9VMyvuNyV-u4W_Elu7aPkIkDJPBkaJCX7VyRYuU_40AAAFfX6wjvQ&apiKey=AIzaSyBYyuJ-1E3ufujlzdKhj8gE9I6QH8TreJE

If you didn't ask to verify this address, you can ignore this email.

Thanks,

Your Ordino team

Fig. 5: Account creation confirmation e-mail

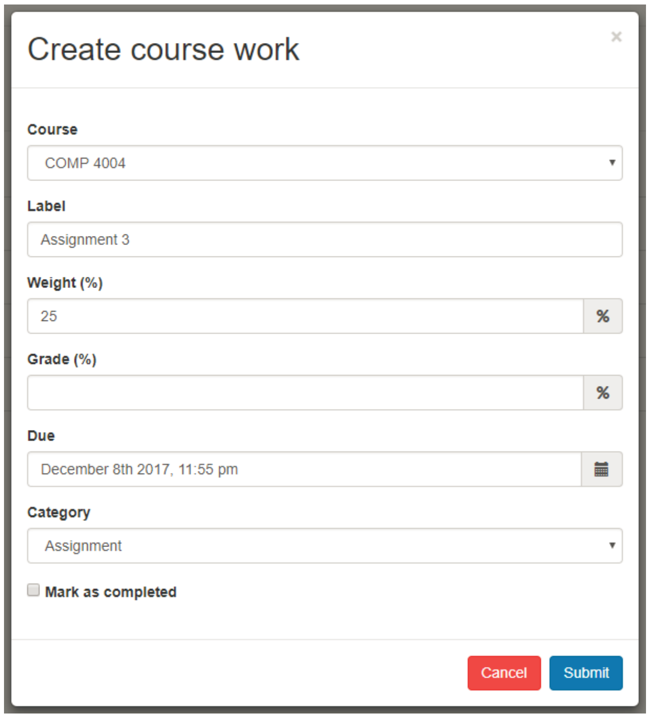
With the backend now able to support user accounts, I began to work on the creation and modification of user data. Ember Data provides a base model object class which is to be extended by each model type used within the application. Model class definitions can specify the type of each property. I defined each model needed for the application such as study terms, courses, course work, and course work categories. This was my first experience designing schemas for a NoSQL database. SQL databases require a primary key for each table to maintain data integrity, whereas NoSQL schemas do not need a primary key. When using Firebase, an *id* property is automatically provided for each model object instance. This property is a randomly generated hash string that is guaranteed to be unique, making each record distinguishable without the need for a primary key. Defining relationships with

Ember Data was also different than defining relationships in SQL. In SQL, composition relationships are implicit and defined using foreign keys. Ember Data models can explicitly specify relationships within the model definition. One-to-one relationships are defined using the *belongsTo* method and one-to-many relationships are setup using the *hasMany* method. I had to decide whether I wanted to take a compositional approach where my relationships were defined by storing all members as an array within the container type, or storing the ID of the container type as a property of the member type. I decided on the latter approach because Firebase documentation recommends keeping each model type separate [Anon., 2017f]. Instead of returning one large chunk of data which may return data that is not needed, it forces the developer to query for only the relevant data that is used in the given area of the application. With the ability to communicate with Firebase and my schemas defined, I was then able to store all the different types of user data objects used in the application. Figure 6 shows an example of a data model definition for category objects in my application.

```
export default DS.Model.extend({
    'uid': DS.attr('string'),
    'label': DS.attr('string'),
    'icon': DS.attr('string'),
    'index': DS.attr('number')
});
```

Fig. 6: Category data model definition

I began implementing the pages for creating and listing data model instances. This gave me my first experience implementing components. For each model type, I implemented a modal dialog component for the user to enter in data for creating new instances of the model type. Abstracting the modal dialogs into components had a couple of advantages. First, I was easily able to reuse the modals for creating new model instances and editing existing instances, across multiple application pages. Second, it is hard to do acceptance testing of a Firebase application to test the user interface, but it is easy to write Ember integration tests for a single rendered component. Figure 7 shows a screen capture of the modal dialog used for creating and editing course work model objects. In addition to modal dialogs, I created a common *ordered-list* component to allow users to assign an order to their model instances, such as terms and course work. To make it work with every single type of model object, the component sorts the items based on their *index* property, and the consumer of the component must supply a renderer to produce the view displayed for each list item. Each renderer is itself also a component, being supplied with the item for a given index and producing the view for that item. Figure 8 shows the *ordered-list* component being used to display all the course work for a given course.


Create course work

×

Course: COMP 4004

Label: Assignment 3

Weight (%): 25 %

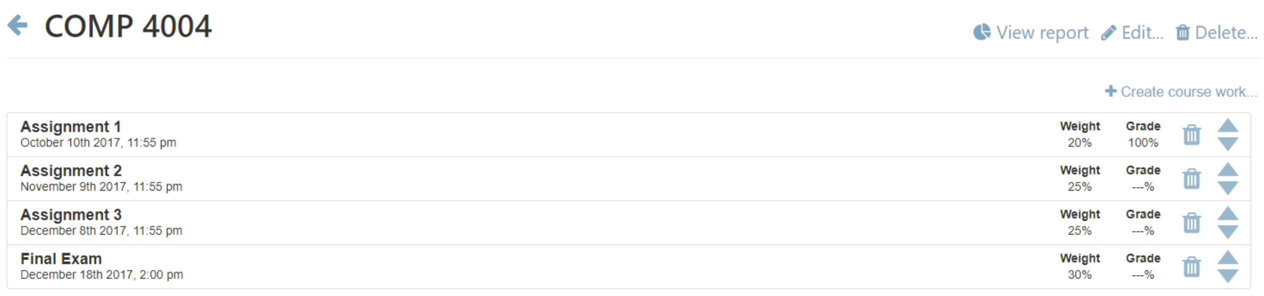
Grade (%): %

Due: December 8th 2017, 11:55 pm

Category: Assignment

Mark as completed

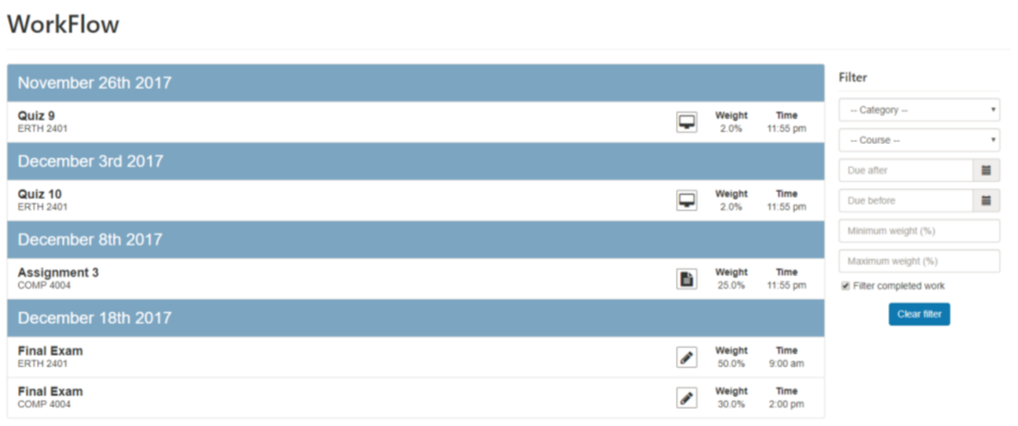
Fig. 7: Modal dialog for creating (and editing) course work


COMP 4004

Assignment 1 October 10th 2017, 11:55 pm	Weight 20%	Grade 100%
Assignment 2 November 9th 2017, 11:55 pm	Weight 25%	Grade ---%
Assignment 3 December 8th 2017, 11:55 pm	Weight 25%	Grade ---%
Final Exam December 18th 2017, 2:00 pm	Weight 30%	Grade ---%

Fig. 8: List of existing course work displayed in the ordered-list component

There are three main application features that process and make use of the user's data. The first feature is named *WorkFlow*. *WorkFlow* lists all upcoming deadlines for the current study term, sorted by deadline, and grouped by date. There is also a series of filters to narrow in on which work items are displayed, such as the course the work item belongs to, the category the work item is in, and the date range of deadlines to show. To accomplish this, I created a *filtered-list* component. Like the *ordered-list* component, a renderer can be provided to customize how each list item is displayed. The *filtered-list* component also takes a list of filter objects. Each filter object includes the filter value to watch, the user interface component linked to the filter that the user can enter the filter value into, and a validator function to test whether an item passes the filter. Only the items that pass all the set filters are displayed. The filtering is dynamic meaning that whenever a filter value is changed, all items are automatically tested against the new current filter values. I also used the *filtered-list* component in the course list page. Since the component is generic, it was easy to group the courses by term instead of a date and supply a different list of filters. Figure 9 shows the *filtered-list* component being used in the *WorkFlow* feature and Figure 10 shows the *filtered-list* component being used in the course list page.


WorkFlow

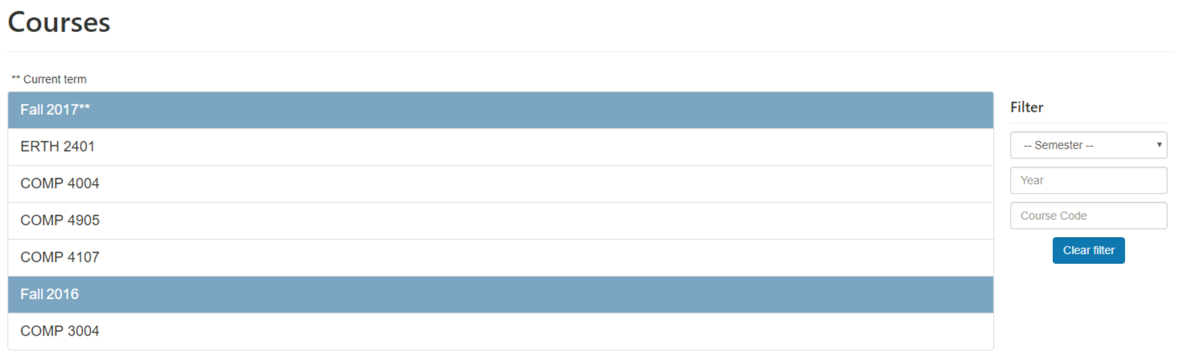
November 26th 2017
Quiz 9 ERTH 2401 — Weight 2.0% — Time 11:55 pm

December 3rd 2017
Quiz 10 ERTH 2401 — Weight 2.0% — Time 11:55 pm

December 8th 2017
Assignment 3 COMP 4004 — Weight 25.0% — Time 11:55 pm

December 18th 2017
Final Exam ERTH 2401 — Weight 50.0% — Time 9:00 am
Final Exam COMP 4004 — Weight 30.0% — Time 2:00 pm

Fig. 9: WorkFlow making use of the filtered-list component


Courses

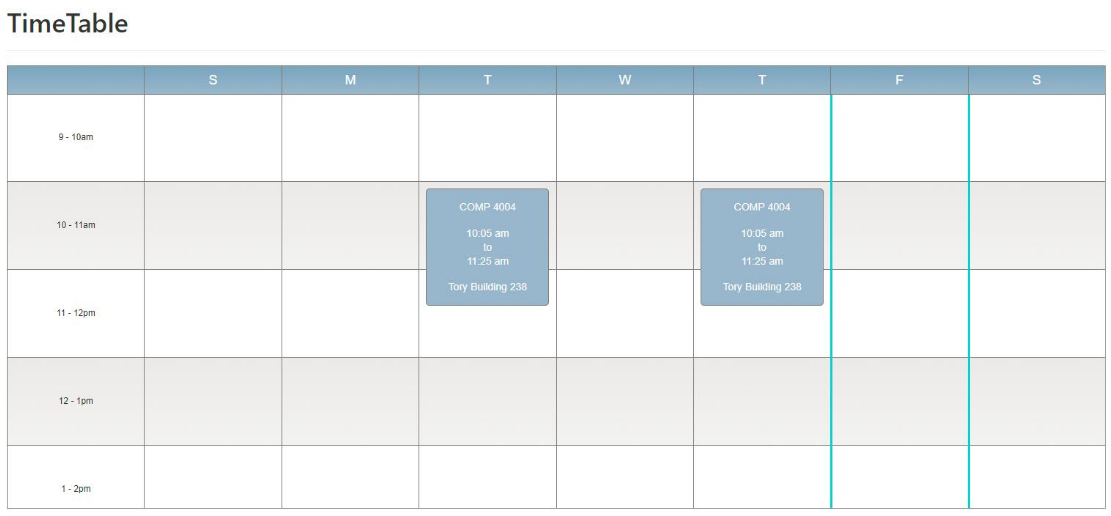
** Current term

Fall 2017**
ERTH 2401
COMP 4004
COMP 4905
COMP 4107

Fall 2016
COMP 3004

Fig. 10: Course list making use of the filtered-list component

The second main feature is *TimeTable*. *TimeTable* displays the user's weekly class schedule. I again decided to extract the weekly schedule implementation into a component to ease the testing. I decided to layout the *week-schedule* component as a table, each column corresponding to a day and each cell corresponding to one hour. Creating the table layout was logical to figure out using a flexbox approach. To have an accurate scale, I allotted two pixels per minute, making each cell 120 pixels in height. The hard part was determining how to overlay the class time bubbles over the underlying table. The way I decided to accomplish this was setting an *absolute* position for each bubble. I calculated the number of minutes from midnight and multiplied that by the allotted two pixels per minute to get the top position of the class time bubble. I then calculated the minutes between the start and end time of the class, multiplying that by the two pixels per minute to get the total height of the class time bubble. The template highlights the right and left side of the column corresponding to the current day. When the *TimeTable* page is first opened, the route controller scrolls to the top of the current hour. This allows the user to easily see where they are in the current week and which classes they have soon. Figure 11 shows the *TimeTable* feature using the *week-schedule* component.

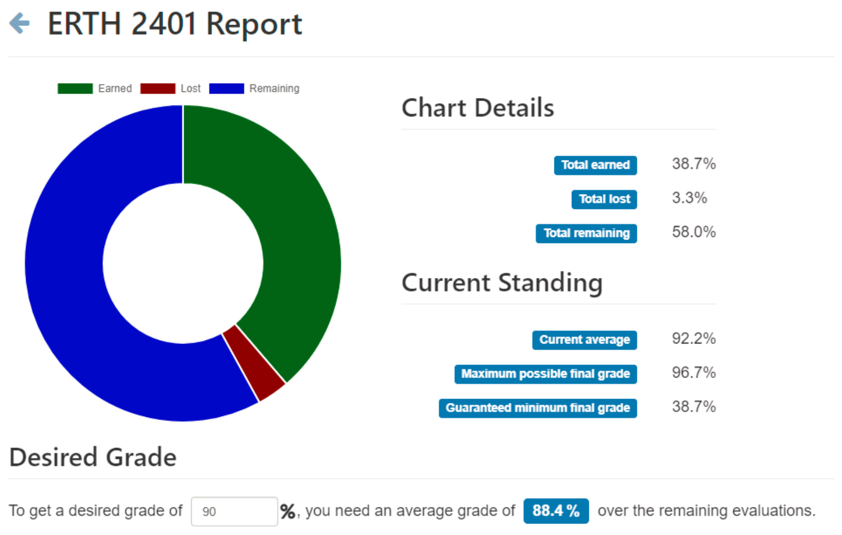


TimeTable

	S	M	T	W	T	F	S
9 - 10am							
10 - 11am			COMP 4004 10:05 am to 11:25 am Tory Building 238		COMP 4004 10:05 am to 11:25 am Tory Building 238		
11 - 12pm							
12 - 1pm							
1 - 2pm							

Fig. 11: TimeTable making use of week-schedule component

The final main application feature is the *course report*. As a student, I am always keeping track of how I am doing in all of my courses. With the click of a button, the course report renders a one-page summary of how the user is doing in a particular course. The report gives various statistics to inform the user how they are currently doing and how close they are to obtaining their desired final grade. Some example statistics are their current average, guaranteed minimum final grade, and maximum possible final grade. The user can enter a desired grade and see what average they need over the remaining evaluations to earn that desired grade. Since most reports have visual aids, I decided to place a doughnut chart in my report. The chart shows the percent of the total marks the user has already earned, the percent of total marks that have been lost, and the percent of total marks remaining. I used *Chart.js*, a popular JavaScript chart library, to create the doughnut chart. Much like *emberfire*, an open-source Ember addon had been created that wraps the library. The addon allows for the use of the various kinds of charts *Chart.js* supports as components in Ember applications. To compute all the report statistics, I decided to create a utility function. The function takes an array of course work model objects as a parameter. It processes the weight and grade of each course work object and then returns a JSON object with all the computed statistics that the report uses. Figure 12 shows a rendered course report with the user's required grade computed, among other related statistics.



ERTH 2401 Report

Chart Details

Total earned	38.7%
Total lost	3.3%
Total remaining	58.0%

Current Standing

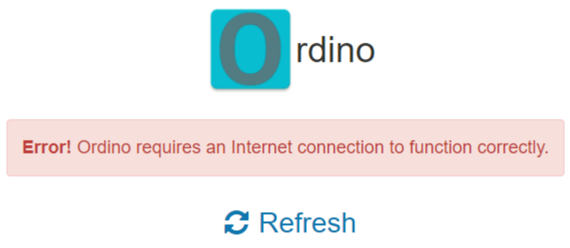
Current average	92.2%
Maximum possible final grade	96.7%
Guaranteed minimum final grade	38.7%

Desired Grade

To get a desired grade of 90 %, you need an average grade of 88.4 % over the remaining evaluations.

Fig. 12: Rendered course report

Towards the end of developing the application, I noticed a major issue. When the Internet connection was lost, the application kept functioning normally. The user could still navigate between pages, and change their model data. This was a problem because without an Internet connection, there was no synchronization of data with the cloud database. The user could make changes, thinking that it was being saved, and then realize that it was not saved when they regained their Internet connection and refreshed the page. I found an NPM module named *is-online* that tries to connect with a few websites to determine if the client can access the Internet. With this module, I could easily check the connection status on the initial application launch, but this still did not solve my problem of handling the loss of the Internet connection in the middle of using the application. I decided to poll the Internet connection status every so often. Since I knew that knowing the Internet connection status could be useful in many areas of the application, I decided to extract this into an Ember service. Up until this point, I had used Ember services but never created one. Creating a service is not any more difficult than creating a route or controller. On initialization of the service, a loop is launched that checks the Internet connection every fifteen seconds. The service has a property named *isOnline* that indicates whether the client is connected to the Internet or not. In the root *application* template, I ensure that if there is no Internet connection, an error message is displayed instead of application content as shown in Figure 13.



Error! Ordino requires an Internet connection to function correctly.

Fig. 13: No Internet connection error message

While creating the service, I came across many Ember addons that indicate if the client has a local connection, but none of these indicate if the client has an Internet connection. I decided that the service I created would be great to extract into an Ember addon to aid other developers with the same problem I had. There are a few differences between developing Ember applications and Ember addons. First, the development code for modules, such as services, is written in the *addon* directory instead of the *app* directory. The modules are then exported from the *app* folder. Second, a *dummy* application can be created in the *test* folder. The *dummy* application is launched by the *ember serve* command so that the addon components can be tested in an application context. With the skeleton addon created, I moved my service into the addon. The *environment.js* file of an Ember application can be used to configure services. I decided to allow users of the addon service to be able to configure the interval between Internet connection checks using the *environment.js* file. I also allowed users to configure the *is-online* module specific options. I named this addon *ember-online-status* and published it to NPM[1]. I was able to install the addon from the command line into my Ember application and integrate the service.

For the sake of providing easy access to the web application functionality, I used Firebase's free hosting service to host the Ember portion of the application. Github easily integrates with an open source continuous integration tool named *Travis CI*. Whenever a *git push* is made to the *master* branch of the Github repository, a Travis build is triggered. The Travis configuration I implemented runs all the tests I wrote for the application. If all those tests pass, the tests coverage results are published and a production build of the web application is deployed to the Firebase hosting service. Up until this point, I had only tested the Ember web application locally on my computer. When I initially accessed the web application from the remote host, there was a delay while loading the application during the initial connection. During this delay, a blank screen was displayed with no indication of what was going on. To fix this potentially confusing problem, I learned about *substates* in Ember. There are two kinds of substates which are *loading* and *error*. The Ember router will transition into the loading substate while

[1] https://www.npmjs.com/package/ember-online-status

the given route is still in the process of loading, possibly from a large data query. When in the loading substate, the provided template is displayed if one was provided. For example, if the current route was *courses.course*, where *courses* is the parent route of the *course* route, Ember would first check if a template existed in the application with the path *templates/courses/course/loading.hbs*. If a file with that path did not exist, then Ember would next check if a file with the path *templates/courses/loading.hbs* existed. Additionally, a top-level application loading template can be created with path *templates/application-loading.hbs* that would be displayed whenever the loading substate is not handled by any route on the current route's path. With the above knowledge, I created an application loading template that is rendered when the application is initially accessed and informs the user that the application is busy loading (see Figure 14). I also created a loading template that is rendered when data is being loaded by a route (see Figure 15).

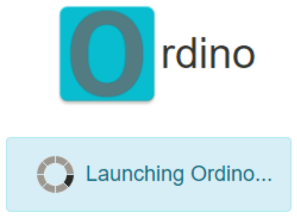


Fig. 14: Application loading substate template

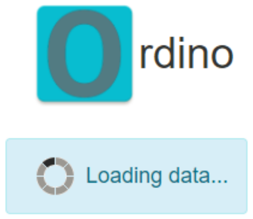


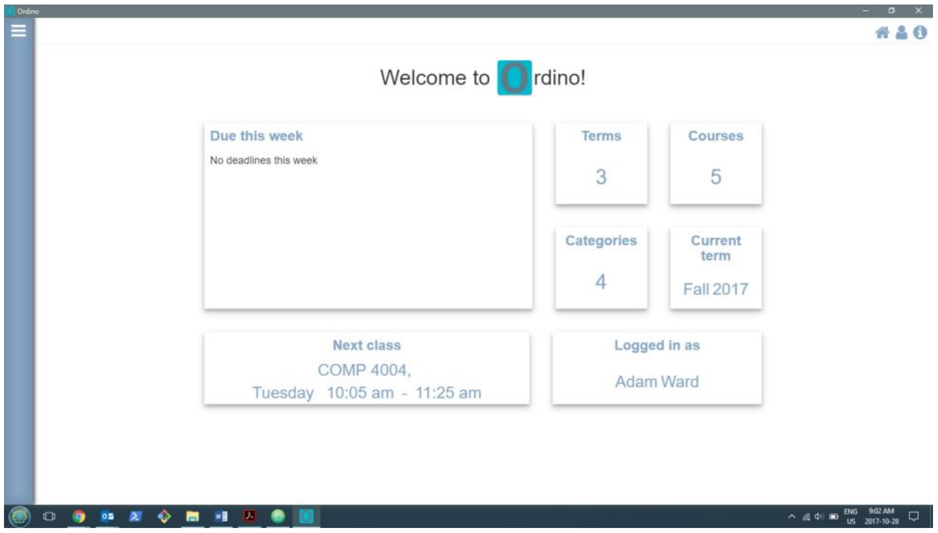
Fig. 15: Loading substate displayed when a route is busy loading data

4.2. Building as an Electron application

With all the pages created for the Ember web application, the backend of the application was complete. I was now left with the task of building the Electron desktop application using the Ember backend. Electron builds an executable for the current operating system. The executable launches a Chromium window that displays the pages rendered by the backend Node server. The pages are displayed the exact same way as they are in a web browser.

An Electron application can be created using as little as three files. A standard *package.json* is needed that includes a *main* property which specifies the path to the *main* script for launching the Electron application. The *main* script creates the desktop application window and processes window related events such as maximizing, minimizing, and closing. This is where a developer can specify their application window size which I made full screen by default. The location of the content that needs to be loaded by the Chromium window is specified in the *main* script. This can be the path to a single HTML file or a web application URL. In my case, I needed to configure Electron to point to my Ember web application. There is an addon named *ember-electron* that aids in the initialization of Electron desktop applications with an Ember backend. Addons can define blueprints which can be used to insert code and default configurations into existing files, or generate new files in an Ember application. These blueprints are simply executed using Ember CLI's *generate* command. The *ember-electron* blueprint creates a *main.js* file to be used as the Electron *main* script, handling the launching of the Electron application window and the loading of the Ember backend. The blueprint also adds all the necessary dependencies needed to build the Electron application.

Using the default setup, I was able to build and run the Electron application, but the Ember backend would not function properly. I determined that the source of the problem was that the Ember portion of the application could not communicate with Firebase. After scouring through both Firebase and Electron documentation, I realized why this communication was not working. The *main.js* file created by the *ember-electron* blueprint creates a custom protocol named *serve* and uses *dist* as the hostname for the backend server. Firebase blocks communication with all hosts that are not on an approved host list. Unfortunately, I could not simply add *serve://dist* to this list, as Firebase only recognizes hosts that use either the HTTP or HTTPS protocols. With Electron and Ember being relatively young technologies, research did not provide any solutions to this problem. I was only able to solve the problem after learning how Ember CLI builds a web application for deployment. I was under the impression that Ember web applications were launched the same as Node scripts, listening for requests on a specified port, just like Express web applications. By looking at the compiled web application, I realized that Ember compiles all the application code, including templates, into one JavaScript file. There is then a single *index.html* file that the compiled script is injected into. As a result, Ember applications are single-page web applications. While navigating through the various routes of the application, only the content for the current route is rendered. Opening this one *index.html* file allowed me to use all of the application features normally. This gave me the idea of statically serving the compiled Ember web application. Using the *connect* and *serve-static* modules, I launched a static file server on port 4200 and set the URL to load in the Electron window to *http://localhost:4200*. See Appendix B for the full Electron *main.js* file for the application.


Welcome to Ordino!

Due this week

No deadlines this week

Terms 3

Courses 5

Categories 4

Current term Fall 2017

Next class

COMP 4004,

Tuesday 10:05 am - 11:25 am

Logged in as

Adam Ward

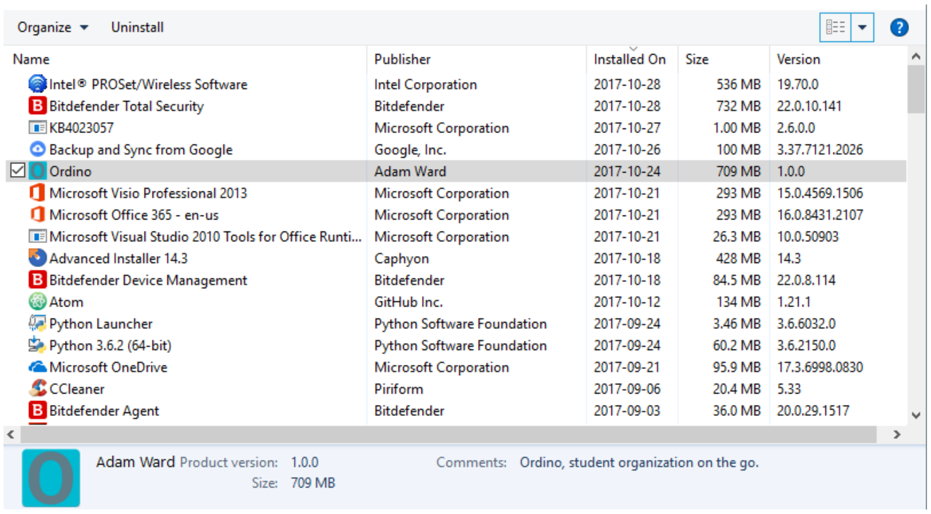
Fig. 16: Ordino running as an Electron application on Windows

With the static file server running using an HTTP protocol, the Electron application was able to communicate with Firebase. The Electron application was then able to launch and run as expected (see Figure 16). The only problem left was that the application could no longer be launched as an Ember web application, accessible by a web browser. It is much faster to launch the application as an Ember application, saving a lot of time while testing changes. Additionally, Electron applications, such as Slack, often host the application on a web server separately so that the application can be used as a web application or a desktop application. As it turns out, this was only a matter of using a conditional statement in the *environment.js* configuration file for the URL type of the application, as exemplified in Figure 17. Electron requires a *hash* type URL where the URL is anchored with a *#*, whereas when run as a web application the URL does not need to be anchored by a *#.*

```
locationType: process.env.EMBER_CLI_ELECTRON ? 'hash' : 'auto'
```

Fig. 17: Environmental configuration to run as web application or Electron desktop application

In addition to providing the initial Electron configuration blueprint, *ember-electron* adds commands to Ember CLI for packaging executables. Executing the *ember electron:package* command packages an executable for the current platform and architecture. The process of compiling and packaging an Electron application is unified by *electron-forge*. The *electron-forge-config.js* file can be modified to specify the executable icon, executable name, and executable file description, among other settings. Running the package command creates the executable, and including all necessary DLLs and resources to run the application on any system of the same platform without the prerequisites that are needed for development, such as Node and Google Chrome. Using Advanced Installer, I was able to produce 64-bit and 32-bit Windows installers for the packaged application. I was then able to successfully install the application on my computer (see Figure 18) and run the Electron application without any problems.



Name	Publisher	Installed On	Size	Version
Intel® PROSet/Wireless Software	Intel Corporation	2017-10-28	536 MB	19.70.0
Bitdefender Total Security	Bitdefender	2017-10-28	732 MB	22.0.10.141
KB4023057	Microsoft Corporation	2017-10-27	1.00 MB	2.6.0.0
Backup and Sync from Google	Google, Inc.	2017-10-26	100 MB	3.37.7121.2026
Ordino	Adam Ward	2017-10-24	709 MB	1.0.0
Microsoft Visio Professional 2013	Microsoft Corporation	2017-10-21	293 MB	15.0.4569.1506
Microsoft Office 365 - en-us	Microsoft Corporation	2017-10-21	293 MB	16.0.8431.2107
Microsoft Visual Studio 2010 Tools for Office Runti...	Microsoft Corporation	2017-10-21	26.3 MB	10.0.50903
Advanced Installer 14.3	Caphyon	2017-10-18	428 MB	14.3
Bitdefender Device Management	Bitdefender	2017-10-18	84.5 MB	22.0.8.114
Atom	GitHub Inc.	2017-10-12	134 MB	1.21.1
Python Launcher	Python Software Foundation	2017-09-24	3.46 MB	3.6.6032.0
Python 3.6.2 (64-bit)	Python Software Foundation	2017-09-24	60.2 MB	3.6.2150.0
Microsoft OneDrive	Microsoft Corporation	2017-09-21	95.9 MB	17.3.6998.0830
CCleaner	Piriform	2017-09-06	20.4 MB	5.33
Bitdefender Agent	Bitdefender	2017-09-03	36.0 MB	20.0.29.1517

Adam Ward Product version: 1.0.0 Comments: Ordino, student organization on the go.
Size: 709 MB

Fig. 18: Application successfully installed on Microsoft Windows

I wanted to make these installers available from only the Ember web application as it would be redundant to download the installers from the Electron application. I set out to find a way to distinguish accessing the application from a web browser versus an Electron window. The Electron window adds the version of Electron being used to the global JavaScript *window* object. The Electron version then can be accessed as *window.process.versions.electron* from any part of the Ember portion of the application. By checking to see if this version value was set, I was able to provide download links for the packaged installers only when the application was accessed from a web browser. These installers can be downloaded from https://ordino-b5acf.firebaseapp.com by clicking on the download icon and selecting a download link from the modal dialog, as shown in Figure 19.

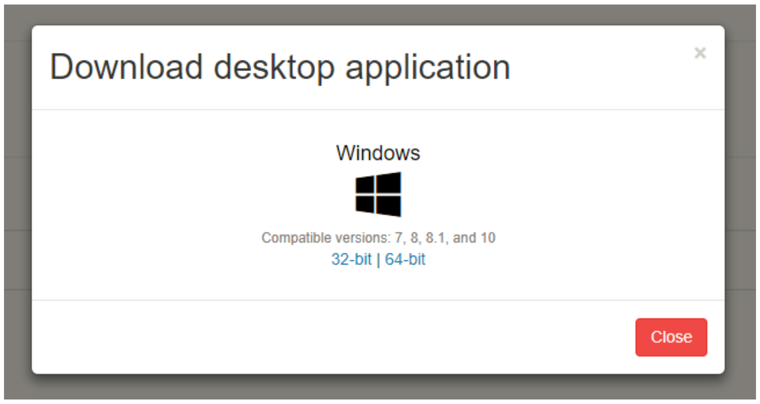

Download desktop application
×
Windows
Compatible versions: 7, 8, 8.1, and 10
32-bit | 64-bit
Close

Fig. 19: Modal with links for downloading the Windows installers

5. Comparison of Ember.js and Express.js

There are a number of similarities and differences between the Ember and Express Node frameworks. The similarities are vastly outnumbered by the differences. Changing a web application from one framework to the other would certainly require a full re-write. The similarities are the more general attributes of any framework. The differences come from the two frameworks having two completely different design philosophies.

All Node applications have the ability to import modules to reuse existing functionality. There are already many open-source modules available in the NPM repository that can be used. There are, however, framework specific modules that tie in with the respective framework's design philosophy. Both Ember and Express have their own special kind of modules. For example, Ember *addons* are the common format for distributing Ember specific libraries [Erdi, 2017]. They easily allow helpers, services, components, and mixins to be shared across many Ember applications. In contrast, Express has its own special type of modules called *middleware* [Anon., 2017c]. Middleware are functions that are given access to the request and response objects [Anon., 2017c]. They can execute some code or alter the request or response objects in some way [Anon., 2017c]. Both addons and middleware allow for plugging functionality into an existing application while not violating the philosophy of the respective framework. Ember addons make it easier to create complex Ember web applications by allowing the developer to incorporate existing solutions to a problem so that they can focus on the application functionality and business logic. When creating an Express application, a developer only needs to install the middleware they require. As such, middleware reinforces the Express philosophy of creating minimalist, fast web servers that are not bloated by unnecessary code.

Both the Express and Ember frameworks can integrate a templating engine. While Ember applications come with a default templating engine, Express applications do not. The developer can add the templating engine of their choice when using Express, if desired. This again matches the Express philosophy of creating minimalist web servers, by leaving it to the developer to plugin a template engine if they need one. When creating an Ember application, Handlebars is included as the default templating engine. It is possible to swap the templating engine used by Ember to a different one, such as Jade, but a developer then loses the Ember specific template helpers. This follows the Ember philosophy as including the Handlebars template engine by default is one design decision a developer does not need to make. Additionally, the specialized template helpers aid in creating complex applications.

There are many differences between the process of developing an Express web application and an Ember web application. Firstly, Express is much more liberal in how a web application can be developed as routes can all be defined in the main JavaScript file or defined in separate files [Anon., 2017c]. Additionally, a route method can be defined on a per GET or POST request basis, or can create chained route handlers that handle all request types for a given path [Anon., 2017c]. Whereas, in Ember, each route has its own file that must have a specific name, and be in a specific folder, which makes developing an Ember application much stricter. Express also leaves a lot of decisions for the developer to handle. For example, query parameters must be parsed from all requests sent to an Express web application. In contrast, query parameters are handled much differently in Ember as the developer can specify the names of all expected query parameters in a route's controller. The framework then handles the parsing of the query parameters and automatically assigns them to variables of the same name. These query parameter values can be accessed like any other controller property. Any changes to the corresponding query parameter property results in the query parameter being automatically updated in the URL. This is exemplified in the *WorkFlow* and course list features of my application where the current values of the set filters are part of the page URL as query parameters.

Overall, I found it much easier to develop a web application with Ember than Express. Express would be a great alternative to Apache as a static file server or for small text based websites. However, it falls short when wanting to make a complex web application. A lot of tasks, such as dealing with query parameters, required more complicated, messy solutions in Express, but were incredibly easy and concise in Ember. With so many setup and design decisions made for you, Ember makes it a lot easier to quickly add functionality to your web application. Once I got used to the structure of Ember applications and all the common idioms, they became second nature and I was able to quickly add functionality to the application. My thoughts became strictly about implementing functionality as I did not have to be concerned about the design of the application. Additionally, there was never a point where I felt restricted by the decisions Ember has forced upon developers.

Finally, deploying a web application is much easier with Ember. Express servers must be launched and actively listening to a port for requests to come in. There are cloud platforms for hosting these kinds of Node applications, but they are more expensive than hosting services that serve static files. When a production build of an Ember web application is done, there is a single *index.html* file which injects in content from the packaged JavaScript files as needed. Thus, the output of an Ember build can be statically served. There are many attractive features and advantages that are driving Ember's growing popularity. Although Express still has its place as a framework for developing fast, little web servers, it cannot compete with frameworks such as Ember for creating high-end, complex web applications.

6. Developing a Desktop Application with Ember.js and Electron.js instead of Java

During three of my four co-op work terms, I had a software engineering position, each one using Java as the main programming language. As such, I noticed many differences between developing a desktop application using Ember and Electron versus a traditional language, such as Java. Both ways have their advantages and disadvantages which will be discussed in this section.

One of the first disadvantages I noticed about using Electron is that the documentation is not very comprehensive. Much of my total time during my honours project went towards trying to determine what was the purpose of certain configuration properties in the default Electron setup provided by the *ember-electron* blueprint and what were acceptable values for those configuration properties. The available documentation was sparse and explanations were not always clear. Often the answer to a problem was found by reading through forum posts made by people having similar problems. When I could not find any such forum post, I either had to settle for an acceptable but lesser solution, or keep attempting solutions based on educated guesses until one worked. Often the solutions to Electron related problems were not difficult to implement, but were extremely hard to figure out. Java has extensive documentation, making it much easier to learn about a new interface and acceptable configurations. Since more developers are using Java, most general problems have already been experienced by another developer. Research then quickly yields the solution to a problem or you learn something is not possible without spending a lot of time on it. In comparison to the Java documentation, the Electron documentation does not reveal the desired information as nicely.

Conversely, Ember's documentation is incredibly well written. Parameter explanations for functions are well written and the return value of a function is clear. I found the Ember documentation to be better than the Java documentation since most functions have an example usage code snippet below the function documentation. The Ember community is also very involved with many bloggers posting tutorials on how to solve advanced issues that are beyond the scope of the guides and tutorials published on the Ember website. Since more time was spent developing the Ember backend for this cross-platform cloud, desktop application rather than configuring the Electron frontend, I prefer learning about new interfaces and configuration through documentation when developing an Ember and Electron application over a Java application.

Although, the quality of a developed piece of software is much more important than how quickly it was developed. Faster development leaves more time to complete more customer features, thoroughly test the software, and fix outstanding bugs. Development seemed much quicker using Ember and Electron. Any changes made to an Ember application are automatically deployed, even if new files are created. This is also the case when Ember is being used as the backend of an Electron application. Not having to rebuild and restart your application every time you make a change saves a lot of time. Some Java IDE's, such as Eclipse, do hot swap changes, but do not do this after a large refactoring, when a new file is created, or when the change is made to an executing thread. In these cases, the application must be terminated and restarted again. From experience, I know rebuilding an application can take many minutes for even the smallest changes. The speed of deployment made testing changes to my Ember and Electron application much quicker and led to much more efficient development.

User interface development was also much easier with Ember and Electron. The automatic deployment of changes made it much easier to make little tweaks to the CSS styles of the application and see the effect immediately on the user interface. Additionally, the Google Chrome browser window used to access the Ember web application, in addition to the Chromium window launched by Electron, provide a developer tools panel which aided the development of many aspects of the application. The *Inspector* tool allowed me to look at the classes and styles given to HTML elements of the user interface. This was especially useful when classes were dynamically assigned at runtime and CSS properties were dynamically calculated. The tool also enabled me to tweak an element's style without making changes to my application's stylesheets. When there is an issue with a Java user interface, there is no way to inspect which values, such as weights and height, an element has been given. The problem can only be found by reading through the code and mentally detecting the problem.

Debugging is essential when developing any piece of software. This is handled very well whether developing an application using Ember and Electron or Java. Popular Java IDEs, such as Eclipse and Intellij Idea, allow you to set breakpoints at a particular line of code, pausing the execution of the program. It is also possible to set breakpoints that pause whenever an exception is thrown or the value of a particular variable changes. A developer can then find the root cause of the issues by viewing the call stack, looking at the present values of variables, stepping over statements, and entering functions, among other things. A developer does not need an IDE to debug an Ember or Electron application since all popular browsers have developer tools for debugging. Placing a *debugger;* statement in JavaScript code acts as a breakpoint, pausing the execution of the application. A developer can then inspect the call stack, the current values of variables, and walk through the code like they could in a Java IDE. Ember also has a special *{{debugger}}* template helper which will pause rendering of the template so that the values in the template context can be viewed. The Electron application window also has the same developer tools panel, pausing execution when these breakpoints in the backend server are hit. A slight advantage of working with the Google Chrome developer tools, is a developer's project is not handcuffed to a specific IDE. Ember applications can be developed by a team of developers, each using the text editor of their choice.

One can see that there are many attractive advantages for developing desktop applications using Ember and Electron. However, the two technologies by no means are a perfect solution. A major disadvantage of using Electron is that the framework is not stable yet. I would occasionally get intermittent crashes that I could not reproduce. Additionally, a new version of *ember-electron* that was released in the middle of the development of my application updated the dependency versions of many of the Electron packages. After this, I was not able to package the application anymore. I had to determine what versions the Electron dependencies had been when I started the project and force those exact versions be used in my *package.json*. One ill timed failure can cause customers to completely lose confidence in a product which is why this instability may keep many software development teams from using Electron until it becomes more stable. In contrast to this issue, Java is incredibly stable at this point and has been thoroughly tested on many platforms.

Ultimately, there are advantages and disadvantages for developing a desktop application using Ember and Electron or Java. I found that developing an application with Ember and Electron was much faster than using Java, especially when implementing the user interface. As revolutionary as Electron is, it is not as mature as Java. In the software engineering industry, stability is of great importance as users want software that always works as expected. Electron needs to become more stable and better documented to become more appealing to a larger number of developers. Additionally, there are existing issues that need to be fixed so that projects like mine are not forced to use specific versions of Electron and Electron dependencies. Ember, on the other hand, is well documented and already incredibly popular in the web development industry. Once Electron is more stable, Ember would be a great backend Node framework for creating complex desktop applications.

7. Further Experimentation to be done with Electron.js

Although this project dove into many of the working pieces of Electron, there is still much experimenting that can be done to find more limitations and novelties of the framework. First, it would be interesting to experiment with the type of content that can be served by Electron in the Chromium window. Second, it would be interesting to see an Electron desktop application build and run on multiple different platforms. Finally, it would be interesting to experiment with adding in desktop application specific functionality, such as menu bars and context menus.

The application I created statically serves the compiled Ember web application production build files. It would be interesting to have a live Node server in the backend, serving content as requests come in. It would also be interesting to figure out if displaying static files is limited to HTML files. Since Electron uses a Chromium window to display the content provided by the backend, anything that can be displayed in a Google Chrome web browser should, in theory, be possible to display in the Chromium window provided by Electron. Thus, maybe it would be possible to display other file types, such as PDFs and image files, without needing them to be embedded in a webpage.

For this project, I developed and tested the application on a computer running the Microsoft Windows operating system. I was even able to setup a build server that packaged the application as a Windows executable and created MSI installers. Since Electron is meant to create an operating system agnostic desktop application, further experimenting should be done to see how well an application can be built, packaged, deployed, and executed on Linux and Mac platforms. Through research, I found many Windows specific configurations that were needed for *electron-forge* to build the executable for Windows. It would be interesting to see how much more effort is needed to build the executables for

Linux and Mac, to confirm that the Electron framework can produce a fully deployable operating system agnostic desktop application.

There are many major differences between web applications and traditional desktop applications. First, most desktop applications have a menu bar, with various menu options that provide some functionality. Second, desktop applications that deal with text often have a spell checker. Next, users often expect a right-click to produce a context menu in any application. Finally, desktop applications can often make use of platform specific features such as a notification service. All the above differences are missing from the Electron desktop application I created for this project. Essentially, the Electron application is just displaying the web application from within a Chromium window instead of a web browser. I did, however, prove that it is possible to distinguish accessing the backend Node framework from a web browser versus the Electron window by only providing download links for the MSI installers when the application is accessed from a web browser. Open source Ember addons already exist to address all the missing pieces I mentioned above. It would be good to spend more time experimenting with adding in desktop application specific components, such as menus, spell checkers, and file system support, to make an Electron desktop application indistinguishable from a traditional desktop application. These components may, however, prove to eliminate the ability to simultaneously develop a web application and desktop application as I did for this project.

8. Conclusion

By developing this application, I achieved my goal of showing that it is possible to create an Electron cross-platform desktop application using Ember as the backend and the Firebase real-time database service to persist data. I showed that it is possible to deploy an Ember and Electron desktop application in the same way as a traditional desktop application. The Ember and Electron application is packaged as 32-bit and 64-bit executables and deployed by Windows installers.

The philosophies that define the Ember framework made developing an Ember web application completely different from developing an Express web application. The common idioms and best practices that developers are forced to use enabled quick development. Additionally, with the design of the application already decided, Ember allows developers to focus solely on solving the complex problems of their application. The same level of complexity would be hard to achieve using the Express framework. Ultimately, the process of developing a web application was much easier using Ember and will likely eliminate the use of Express from any of my future projects.

As I hoped, Ember, Electron, and Firebase work well together and developing with these technologies has many noteworthy advantages. Specialized developer tools and immediate feedback of code changes leads to very efficient development. The use of Electron could also allow more economical development since the web application and desktop application can be developed simultaneously from the same code base. This means that a company may only need one development team per product, saving money on developer salaries and lowering management overhead costs. Code quality could also be improved with only one code base, since there would be no need for extra code to integrate a common backend data store with multiple different programming languages, ensuring each implementation maintains data integrity. Since Electron applications are also operating system agnostic, there would also be no need for any platform specific code. However, before companies have the same level of trust in Electron as they already do in mature languages, such as Java, and make the switch, the framework needs to be further stabilized.

This project shows that the software development industry is still evolving, with new methods for developing software still being introduced. I obtained promising results by developing a fully functioning and deployable desktop application using Electron and Ember. Ember is a technology which is traditionally used for web application development which suggests that one day, there may be less separation between web application and desktop application development. With a smaller gap between the two industries, software quality could be improved and produced at a quicker rate. Powerful web frameworks, such as Ember, could then serve additional purposes such as aiding in the development of complex desktop applications. As revolutionary as the Ember and Electron frameworks are, they could still be improved upon and further stabilized. However, since these frameworks are less than a decade old, what they already are capable of is very impressive and there is still plenty of time for them to get even better.

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List of Abbreviations

CI – Continuous Integration

CLI – Command Line Interface

HTML – HyperText Markup Language

HTTP – HyperText Transfer Protocol

HTTPS – HyperText Transfer Protocol Secure

IDE – Integrated Development Environment

JSON – JavaScript Object Notation

NPM – Node Package Manager

SQL – Structured Query Language

Appendix A: Setup and Execution Instructions

Dependencies

The following dependencies are needed to build and run the application:

1. Any version of Git installed
2. The current patch release of Node.js version 6.11 installed
3. Google Chrome installed

Setup

The development and testing of the application was done on Windows 10. However, the following instructions should be operating system agnostic:

1. Open a command terminal
2. Install Ember CLI:
   ```
   npm install -g ember-cli
   ```
3. Clone the project Git repository:
   ```
   git clone https://github.com/AdamWard1995/cross-platform-ordino.git
   ```
4. Change into the root project folder
5. Install NPM dependencies:
   ```
   npm install
   ```
6. Install Bower dependencies:
   ```
   bower install
   ```

Running the Application

To run the application as a web application:

1. Serve the web application:
   ```
   ember serve
   ```
2. In a web browser go to http://localhost:4200

To run the application as an Electron application:

1. Run the Electron application:
   ```
   ember electron
   ```
2. Wait for the Electron application window to launch

Running tests

Unit and integration tests were written to verify the application. To run all these tests:

1. Run the test script:
   ```
   npm test
   ```

   This will run linting to statically analyze the code and run all the unit and integration tests in a web browser and an Electron application window

Appendix B: The Electron Main.js file

```
const { app, BrowserWindow } = require('electron');
const { dirname, join, resolve } = require('path');
const connect = require('connect'); // connect server
const serveStatic = require('serve-static'); // serve static files

let mainWindow = null;
let server = null;

app.on('window-all-closed', () => {
  if (process.platform !== 'darwin') {
    app.quit();
  }
});

app.on('ready', () => {
  mainWindow = new BrowserWindow({
    show: false,
    icon: '../public/icon.ico'
  });

  mainWindow.maximize();
  mainWindow.show();

  if (!server) {
    server = connect()
     .use(serveStatic(join(__dirname || resolve(dirname('')), '..', 'ember'))).listen(4200);
  }

  const emberAppLocation = 'http://localhost:4200/';

  // Load the statically served ember application
  mainWindow.loadURL(emberAppLocation);

  mainWindow.webContents.on('did-fail-load', () => {
    mainWindow.loadURL(emberAppLocation);
  });

  mainWindow.webContents.on('crashed', () => {
  });

  mainWindow.on('unresponsive', () => {
  });

  mainWindow.on('responsive', () => {
  });
  mainWindow.on('closed', () => {
    mainWindow = null;
  });
});

process.on('uncaughtException', (err) => {
});
```