Building User Interfaces

React Native 1

Introductory Concepts

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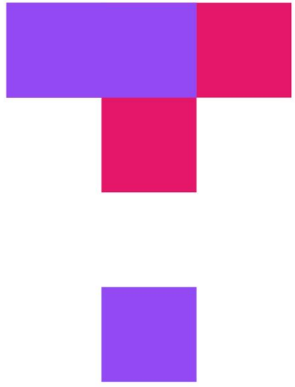
What we will learn today?

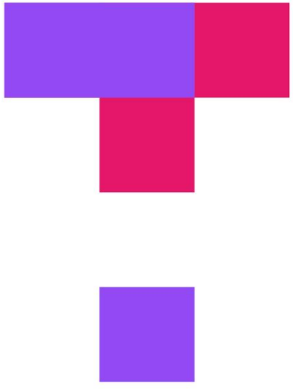
- What is React Native?
- Differences between ReactJS and React Native
- Communicating with Server APIs
- Starting a React Native project

TopHat Attendance



TOP HAT

TopHat Questions



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What is React Native?

What is React Native?

Definition: A JS *framework* for building native, cross-platform mobile applications using React, developed by Facebook in 2015.

Unlike ReactJS, which was a library, React Native is a framework that includes everything that we will need to build mobile applications.

React Native supports **iOS** and **Android** development.

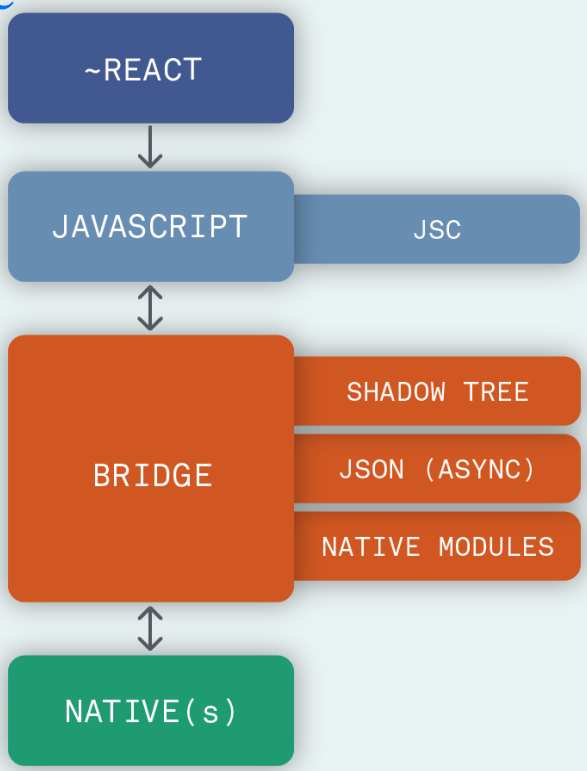
Enables web developers using ReactJS to easily develop mobile applications.

How does React Native work?[1]

As in ReactJS, React Native combines JS and JSX.

Under the hood, React Native runs the program in the JS engine of the host platform (iOS, Android, etc.), which renders and interacts with native UI components, instead of web pages, through a "bridge".

Interacts with native UI elements



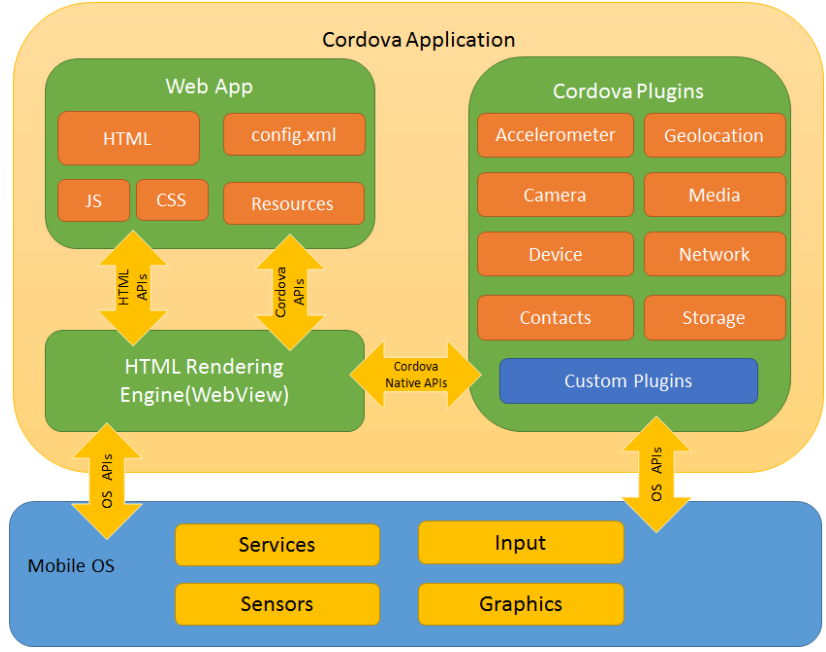
[1] Image source

Alternatives to React Native[2]

All cross-platform alternatives to React Native will wrap HTML + CSS + JS within a web view and simulate mobile UI behavior. Examples:

» Ionic
» Cordova
» Titanium

wrap a web view (browser)



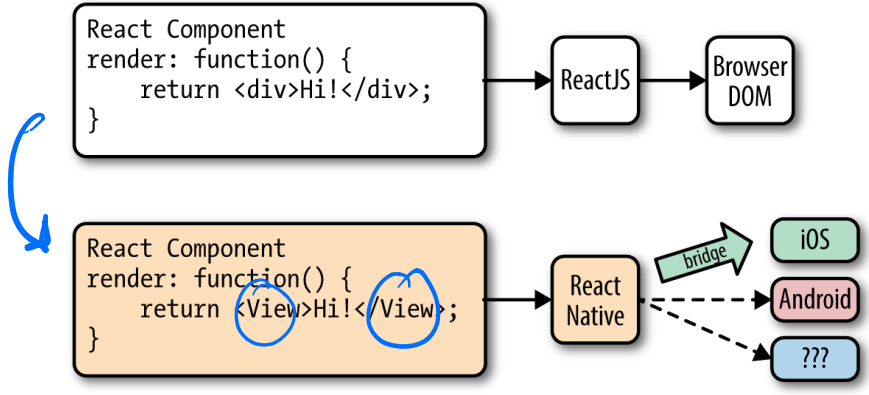
[2] Image source

How is React Native different from ReactJS?

React Native–ReactJS differences[3]

Good news: They are very, very similar.

Minor differences stem from how React Native interacts with the native mobile platform.



[3] Image source

Instead of the HTML DOM, React Native interacts with native components through its Bridge.

Instead of React elements that will become DOM elements, React Native uses elements that are similar but better correspond with native components.

Key difference #1: Core Components[4]

Instead of `div`, React Native uses `View`.

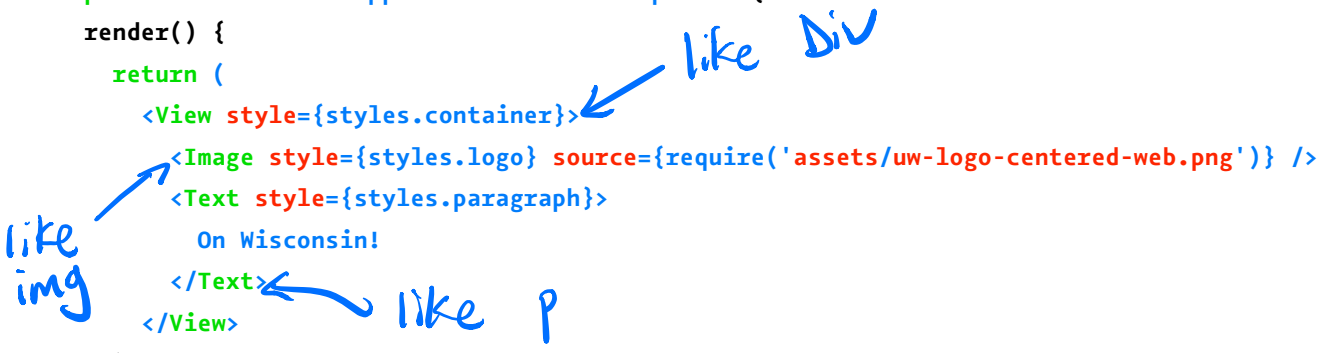
```
import React, { Component } from 'react';
import { Text, View } from 'react-native';

export default class HelloWorldApp extends Component {
  render() {
    return (
      <View style={{ flex: 1, justifyContent: "center", alignItems: "center" }}>
        <Text>Hello, world!</Text>
      </View>
    );
  }
}
```

[4] See code in Snack

Similarly, instead of `p`, RN uses `Text`; instead of `img`, it uses `Image`.[5]

```
export default class App extends React.Component {
  render() {
    return (
      <View style={styles.container}>
        <Image style={styles.logo} source={require('assets/uw-logo-centered-web.png')} />
        <Text style={styles.paragraph}>
          On Wisconsin!
        </Text>
      </View>
    );
  }
}
```



[5] See code in Snack

Additionally, the button clicks trigger an `onPress` event, instead of an `onClick` event.[6]

In ReactJS:

```
<Button onClick={this.updateCounter}>Press me</Button>
```

In React Native:

```
<Button title="Press me" onPress={this.handlePress} />
```

[6] See code in Snack

Key difference #2: Styling[7]

Because RN does not use web elements, we can't use CSS styles. We instead create stylesheets in JS.

```
const styles = StyleSheet.create({
  container: {
    flex: 1,
    justifyContent: 'center',
    backgroundColor: '#ecf0f1',
    padding: 40,
  },
    ...
});
```

[7] See code in Snack

Pro Tip: Style definitions can be done in stylesheets or in props when components are instantiated. You can also combine both methods.[8]

style entry for label

```
<View>
    <Text style={styles.label}>First label</Text>
    <Text style={{fontSize: 28, color:"tomato"}}>Second label</Text>
    <Text style={[styles.label, {fontSize: 20, color:"gray"}]}>Third label</Text>
</View>
```

[8] See code in Snack

Flexbox is Everything[9] [10]

Flexbox is the only standard way of creating layouts in RN, so we have to master it.

```
<View style={{flex: 1, flexDirection: 'column'}}>
    <View style={{flex: 1, backgroundColor: 'whitesmoke'}}/>
    <View style={{flex: 1, backgroundColor: 'gainsboro'}}/>
    <View style={{flex: 1, backgroundColor: 'silver'}}/>
</View>
```

each become 33%

Check this

[9] Visual Flexbox Cheatsheet

[10] React Native Guide to Layouts with Flexbox

Below are the commonly used properties:[11]

`flex: 1` will express how much of the container to fill.

`flexDirection` — `row`, `column`, `row-reverse`, `column-reverse`

`alignItems` — `stretch`, `flex-start`, `flex-end`, `center`, `baseline`

`justifyContent` — `flex-start`, `flex-end`, `center`, `space-between`, `space-around`, `space-evenly`

[11] See code in Snack

Getting Screen Dimension[12]

Mobile devices vary significantly in screen size, and we often need to obtain screen dimensions of the device using the `Dimensions` class in `react-native`.

```
getScreenSize = () => {
    const screenWidth = Math.round(Dimensions.get('window').width);
    const screenHeight = Math.round(Dimensions.get('window').height);
    this.setState({ screenWidth: screenWidth, screenHeight: screenHeight })
}
```

[12] See code in Snack

Key difference #3: Platform-specific Components

RN provides a number of components that utilize platform capabilities that may not be avialable in other platforms, thus for cross-platform development, we need to utilize multiple platform-specific components.

E.g., `TouchableNativeFeedback` only work on Android, and the same effect can be achieved using `TouchableHighlight`.

Moving to platform-specific components deprecated

First method: Selectively render the component based on the current platform.[13]

```
render() {
    if (Platform.OS === 'android') {
       return (
          <TouchableNativeFeedback> ... </TouchableNativeFeedback>
       )
    } else {
       return (
          <TouchableHighlight> ... </TouchableHighlight>
       )
    }
}
```

switch based on Platform (Platform has to be imported)

android-specific component

[13] See code in Snack

Second method: We create two versions of the component, e.g., `MyButton.ios.js` and `MyButton.android.js`.

```
import MyButton from '/components/MyButton';
render() {
    <MyButton />
}
```

automatically imports the correct one!

Key difference #4: Animation & Gestures

Because of the resource-constrained nature of mobile platforms, applications heavily rely on animation and gestures. In RN, CSS animations are not available, but there are several powerful packages:

» Animated API (for animating components)

» LayoutAnimation (for layout animation)

» PanResponder (for gestures)

More on this next week!

Key difference #5: Navigation

Most mobile applications include several *screens*. Using `react-navigation`, we can create several screens and define navigation.

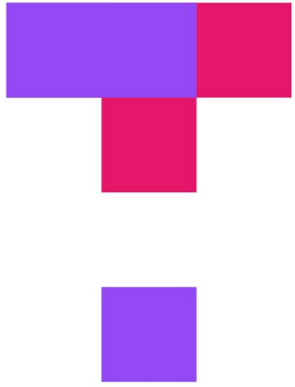
```
import {createAppContainer} from 'react-navigation';
import {createStackNavigator} from 'react-navigation-stack';

const MainNavigator = createStackNavigator({
  Home: {screen: HomeScreen},
  Profile: {screen: ProfileScreen},
});

const App = createAppContainer(MainNavigator);
export default App;
```

More on this next week!

TopHat Quiz



TOP HAT

Communicating with Server APIs

Almost all mobile applications offer personalized information and thus have to know who the user is through *authentication*.

Definition: Authentication identifying a user in the process of providing access to system data or services based on the user's identity.

Common Authentication Methods

- Basic HTTP authentication
  Requires username/password for every request
- Session-based authentication
  Client receives a session ID after authentication, stores it in a cookie, and attaches it to every subsequent request
- Token-based authentication
  Client receives a random token at the first login and passes it as request header in every request

- JWT-based (JSON Web Tokens) authentication
  Client sends encrypted user information and receives a token, which is included in every request and decrypted by the server
- Shared Secret Based Hash Authentication
  A secret stored on the client and the server is used to hash a new token at every request and response

In this module, we will use *token-based authentication*.

Token-based Authentication[14]

The client authenticates with a *username* and a *password* once, receives a token, and only sends the *token* for subsequent requests, until the token times out — works like an all inclusive resort!

[14] Image source

RESTful APIs[15]

Definition: REpresentational State Transfer (REST) is an architectural style for distributed hypermedia systems.

Any information, e.g., an image, can be a *resource*, the key abstraction of REST.

REST uses *resource methods*, e.g., HTTP methods, to facilitate client-server interaction.

[15] More on RESTful APIs

RESTful API Methods

In this module, we will focus on four methods:

- GET → get items
- POST → create items
- PUT → modify items
- DELETE → delete items

GET

Definition: HTTP method to retrieve information from the server in a way that does not change the server (a *safe* method).

`GET` should be *idempotent*, returning the same information every time it is called, until another request (`POST`, `PUT`) changes the resource.

The server will return either `200 (OK)` along with the data (e.g., JSON) or `404 (NOT FOUND)`.

```
HTTP GET http://<our-domain>/users
```

POST

Definition: HTTP method that creates new subordinate resources, e.g., a new user in a collection of users. `POST` is *not* safe or idempotent.

The server will usually return either `201 (Created)` along with information on the new resource and a location header. The server can also return `200 (OK)` or `204 (No Content)`.

`HTTP POST http://<our-domain>/users`

PUT

Definition: HTTP method to update existing information on the server.

The server will return `200 (OK)` or `204 (No Content)`. If the information does not exist, the API may create the resource, as done in a `POST` request, and return `201 (Created)`.

`HTTP PUT http://<our-domain>/users/<username>`

DELETE

Definition: HTTP method that deletes resources from the server.

`DELETE` is *idempotent*, as calling `DELETE` several times does not change the outcome.

The server will return `code 200 (OK)` if the response includes an entity with status, `202 (Accepted)` if the request is queued, or `204 (No Content)` if it is performed but an entity is not included.

`HTTP DELETE http://<our-domain>/users/<username>`

Resource Methods in React Native

For all methods, we can use `fetch()`. React Native `GET` example:

```
fetch('<our-domain>/endpoint')
    .then(function(response) {
        return response.json()
})
```

```
fetch('<our-domain>/endpoint', {
  method: 'GET',
})
```

you have done this

it is implied that you are performing a "GET"

React Native POST example:

```
fetch('<our-domain>/endpoint', {
  method: 'POST',
  headers: {
    'Accept': 'application/json',
    'Content-Type': 'application/json'
  },
  body: JSON.stringify({
    userName: '<user-name>',
    password: '<password>',
  })
})
```

When we pass the userName and password and receive a token, we need to encrypt what we are passing. NPM `base-64` package accomplishes that.

```
import base64 from 'base-64';


base64.encode(username + ":" + password);
```

Passing Authentication Information

Example header to pass user credentials:

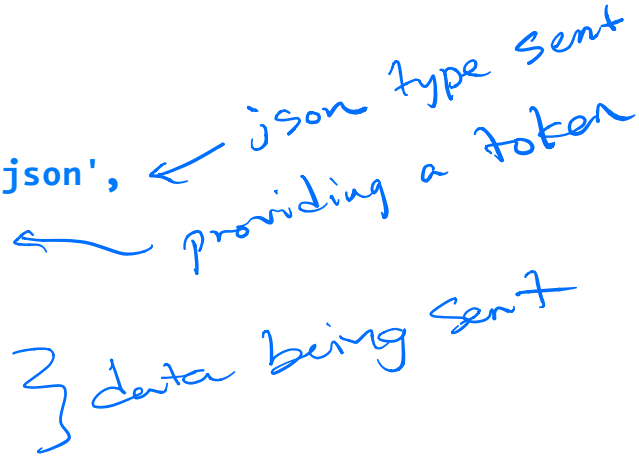
```
'Authorization', 'Basic ' + base64.encode(username + ":" + password)
```

Example header to pass token:

```
'x-access-token', result.token
```

React Native PUT example:

```
fetch('<our-domain>/endpoint', {
    method: 'PUT',
  headers: {
    'Accept': 'application/json',
    'Content-Type': 'application/json',
    'x-access-token': <my-token>
  },
  body: JSON.stringify({
        location: 'Madison, WI'
  })
});
```



React Native `DELETE` example:

```
fetch('<our-domain>/endpoint', {
    method: 'DELETE',
  headers: {
    'x-access-token': <my-token>
  },
});
```

Endpoints

Different resource methods will use different *endpoints* at the server. For example, in the assignment, we will use the following endpoints for `https://mysqlcs639.cs.wisc.edu`:

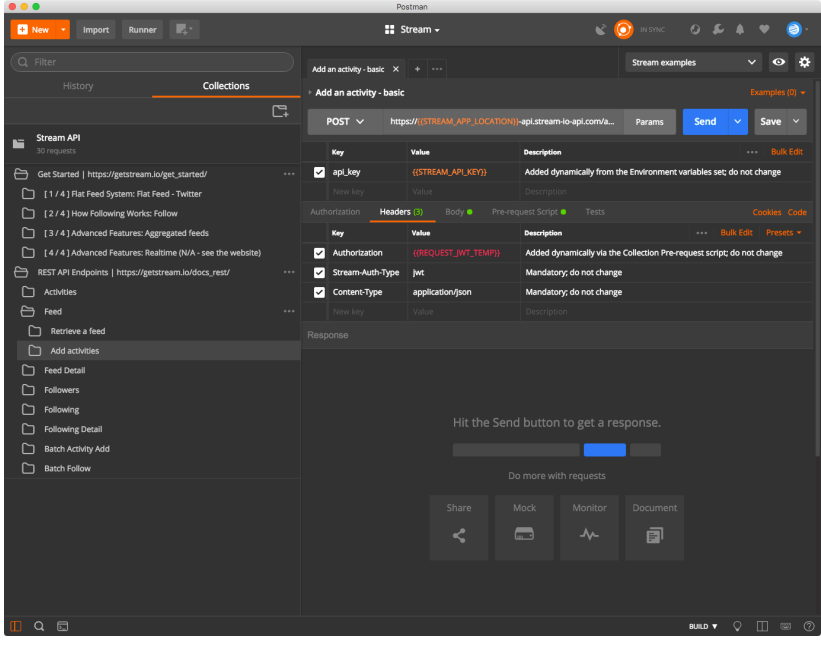
`/login` — allows `GET` to receive the token

`/users` — allows `POST`

`/users/<user-name>` — allows `GET`, `POST`, `PUT`, `DELETE`

Server API Tools[16]

Easy to use tools help setting up server APIs for user authentication, e.g., Postman.



[16] Image source

React Native Authentication Example

Starting a React Native project

Expo[17]

We will use Expo, a set of tools developed to facilitate RN development and testing. To install Expo:

```
npm install expo-cli --global
```

Create and run a new project:

```
expo init my-new-project
cd my-new-project
expo start
```

go here for more info

[17] Get started with Expo

Assignment Preview

React Native 1 + 2 + 3

Design a calorie tracking application.

React Native 1. User login/profile

React Native 2. Exercise and Planning

React Native 3. Recipes and Foods

React Native 1

- Create a “Login” view with username and password input fields
- Create a “Create User” view with username and password fields
- Create a profile view that allows the logged-in user to view and edit their name and goals
- Clean and clear code/interface

The following API can be accessed at `https://mysqlcs639.cs.wisc.edu`.

Route	Auth Required	Token Required	Get	Post	Put	Delete
/login	✓		✓			
/users				✓		
/users/ `<username>`		✓	✓	✓	✓	✓
/meals		✓	✓	✓		
/meals/ `<meal_id>`		✓	✓		✓	✓
/meals/ `<meal_id>` /foods		✓	✓	✓		
/meals/ `<meal_id>` /foods/ `<food_id>`		✓	✓		✓	✓
/activities		✓	✓	✓		
/activities/ `<activity_id>`		✓	✓		✓	✓
/foods			✓			
/foods/ `food_id`			✓			

A Few Tips

- The passwords may not be secure, so do not use a password you use for other accounts.
- Do not create too many accounts.

What did we learn today?

- What is React Native?
- Differences between ReactJS and React Native
- Communicating with Server APIs
- Starting a React Native project