COMP4021
Internet Computing

MVC in Express Part 2

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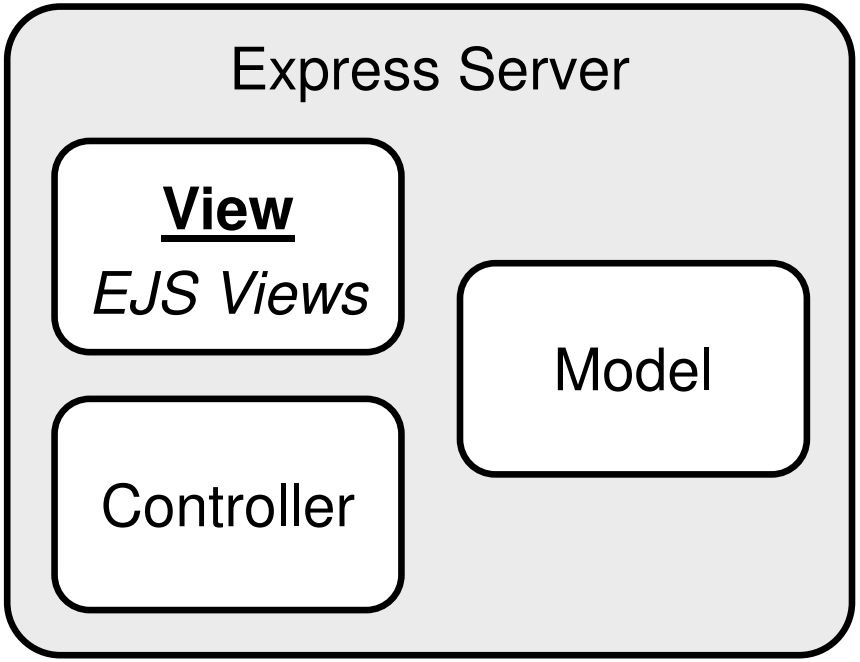
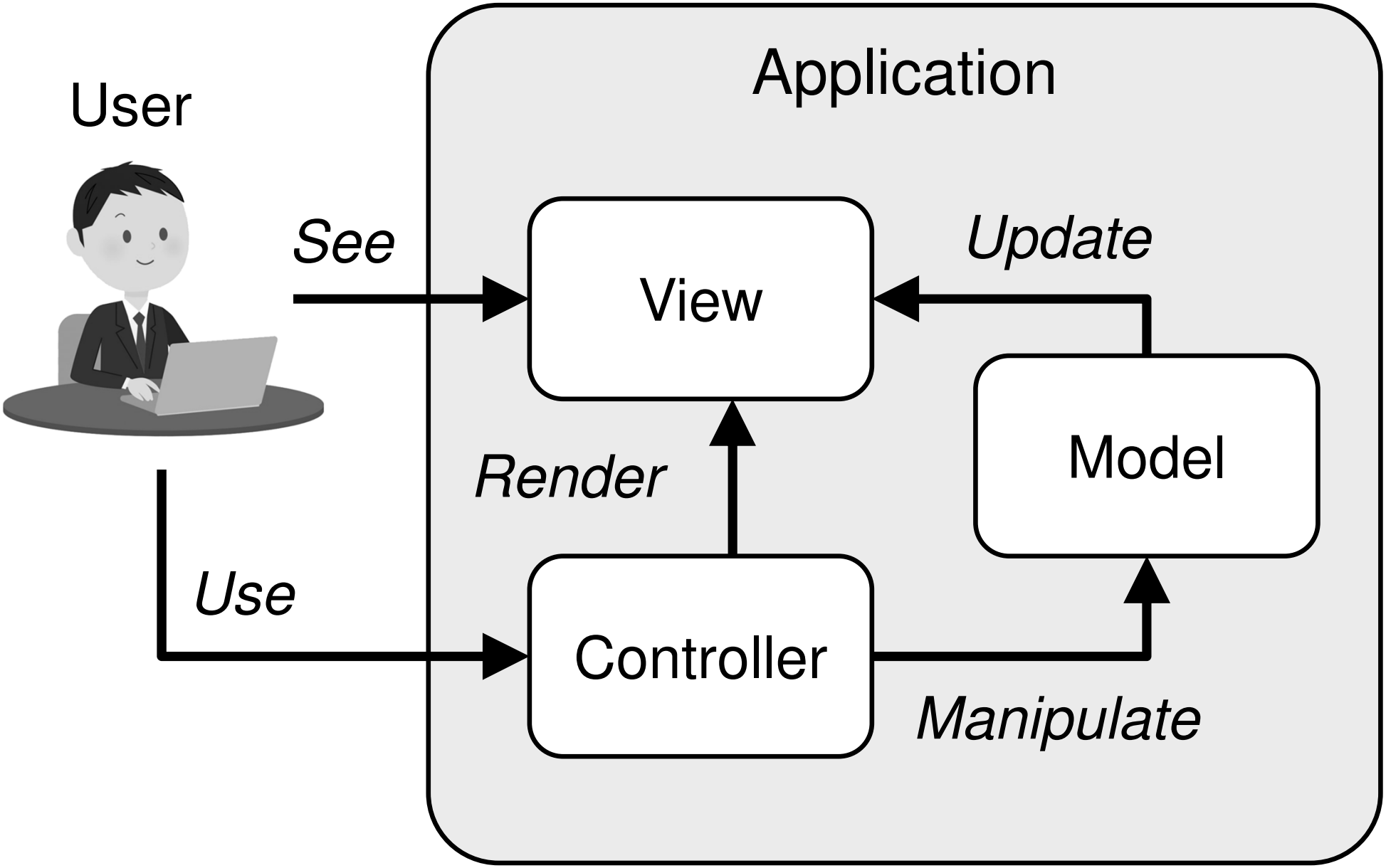
This Presentation

- In the previous discussion, we talked about the MVC design
- We have used EJS in Express to create different views
- In this presentation we will continue with MVC building the models and controllers in Express



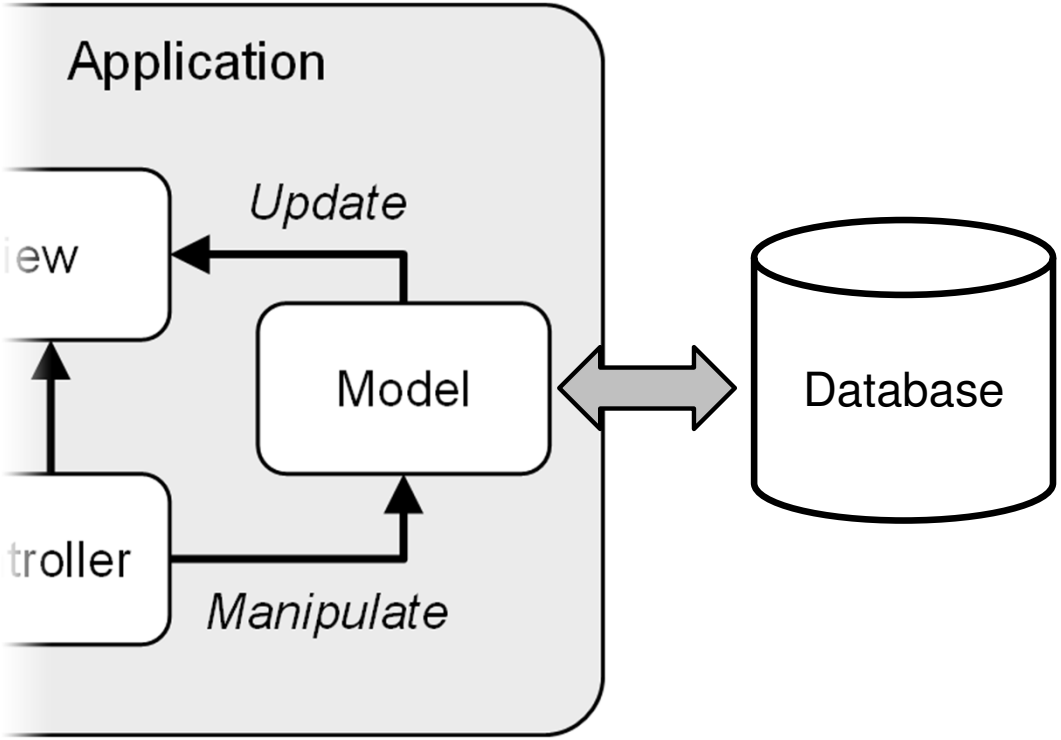
Overview of MVC

You have seen this before



Models in MVC

- Models in MVC manage all data-related functionalities
- Typically, they connect and retrieve data from databases located on some database servers

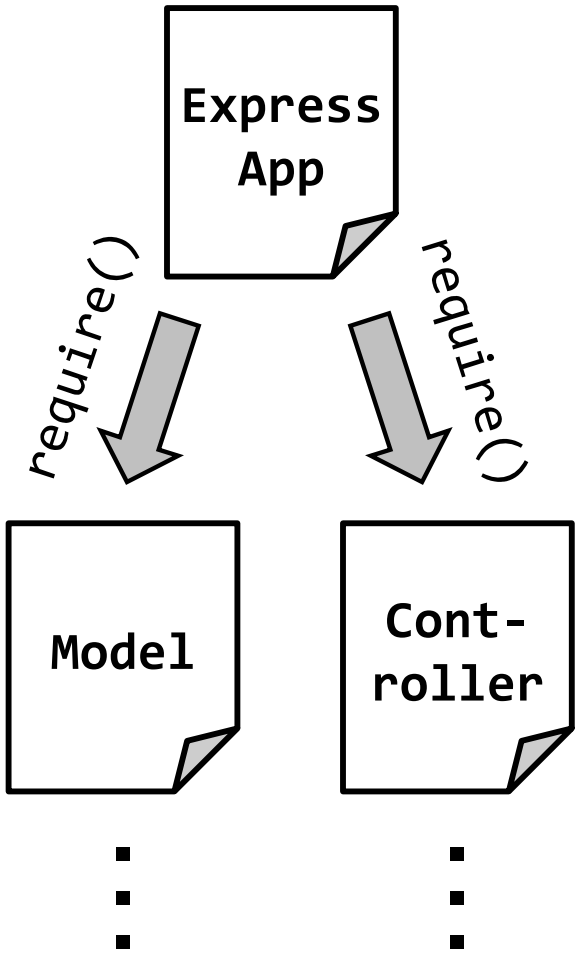


Creating Models in Express

- Since we do not use any ‘real’ database, you can also create a model based on some data stored in, e.g.:
  - CSV files
  - JSON files
  - Remote locations/APIs
- In our example shown later in this discussion, we will use the data from a remote APIs

Using Node.js Modules

- In an MVC Node.js project, you usually put models and controllers in separate files
- You can then use `require()` to import them when you need to
- Node.js modules work in a similar way to the JavaScript module patterns that you have used before



The Exports Object

- In JavaScript module patterns, you create a module using a function
  - The function returns a JavaScript object, which contains the functionalities of the module
- In Node.js, you instead create a module using a global `module.exports` object
  - This object then contains the functionalities of the module and is implicitly returned by the `require()` command

A Simple Module Pattern Example

Increase and get a 'counter' from the module

```
const Counter = function() {
    let count = 0;

    const increase = function() {
        count = count + 1;
    };
    const get = function() {
        return count;
    };

    return { increase, get };
};
```

Using the Module Pattern

- The module pattern in the previous slide can be created using this code:

```
const counter = Counter();
```

- Then, for example, you can increase the counter and get the counter back like this:

```
counter.increase();
const value = counter.get();
```

A Node.js Module Example

- A Node.js module with similar functionalities can be created in a file as shown below:

```
let count = 0;

const increase = function() {
  count = count + 1;
};
const get = function() {
  return count;
};

module.exports = { increase, get };
```

Functions are exported by the `exports` *object*

Using the Node.js Module

- If the file in the previous slide is called `counter.js`, it can be imported by a Node.js program using this code:

```
const counter = require("./counter");
```

- The module can then be used in a similar way to its JavaScript counterpart, i.e.:

```
counter.increase();
const value = counter.get();
```

Making a Stock Model

- A stock data model can be created using a Node.js module
- The stock data is obtained using the Yahoo! Finance API
- A npm package called `yahoo-finance2` lets us download Yahoo's stock data easily

Using Yahoo! Finance

- To get stock data, you need to:
  - Install the package:

```
>npm install yahoo-finance2
```

  - Import the package:

```
const yahooFinance =
  require('yahoo-finance2').default;
```

You need to use `.default` *here*

  - Use either of these functions:

```
yahooFinance.quoteSummary() or
yahooFinance.historical()
```

Getting Stock Data

- For example, you can get the stock summary of Apple Inc using its stock code `AAPL`:

```
const summary =
      yahooFinance.quoteSummary("AAPL");
```

- Or, get its historical stock prices using this code:

```
const prices =
      yahooFinance.historical("AAPL",
      { period1: "2001-01-01" });
```

A Stock Model

- You can create the stock model like this:

```
const yahooFinance =
      require('yahoo-finance2').default;

async function getStock(code) {
  const summary =
        await yahooFinance.quoteSummary(code);
  const prices =
        await yahooFinance.historical(code,
        { period1: "2001-01-01" });

  return { summary, prices };
}

module.exports = { getStock };
```

This is an async function

A single function is exported for getting the stock data

Using the Stock Model

- For example, you can use the stock model (`stocks.js`) to get stock data:

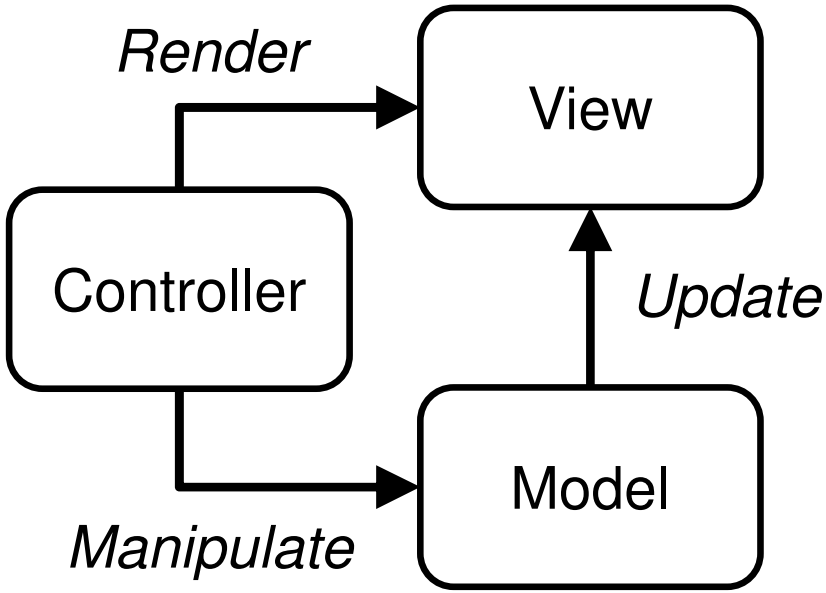
```
const stocks = require("./stocks");

stocks.getStock("AAPL")
  .then((stock) => {
    ...Do something with the stock data...
  })
  .catch((error) => {
    console.log(error.message);
  });
```

You need to use a promise here

Controllers in MVC

- Controllers handle the requests from the users, load the models and pair the models with the appropriate views



- These look exactly like what the routes in Express, i.e. `app.get()` and `app.post()`, can do

Making Controller Modules

- You can group the route callback functions of the same controller into a single Node.js module
- For example, here is part of the content of an ‘authentication’ controller:

```
const signIn = (req, res) => { ... };
const signOut = (req, res) => { ... };
...

module.exports = { signIn, signOut, ... };
```

Importing the Controllers

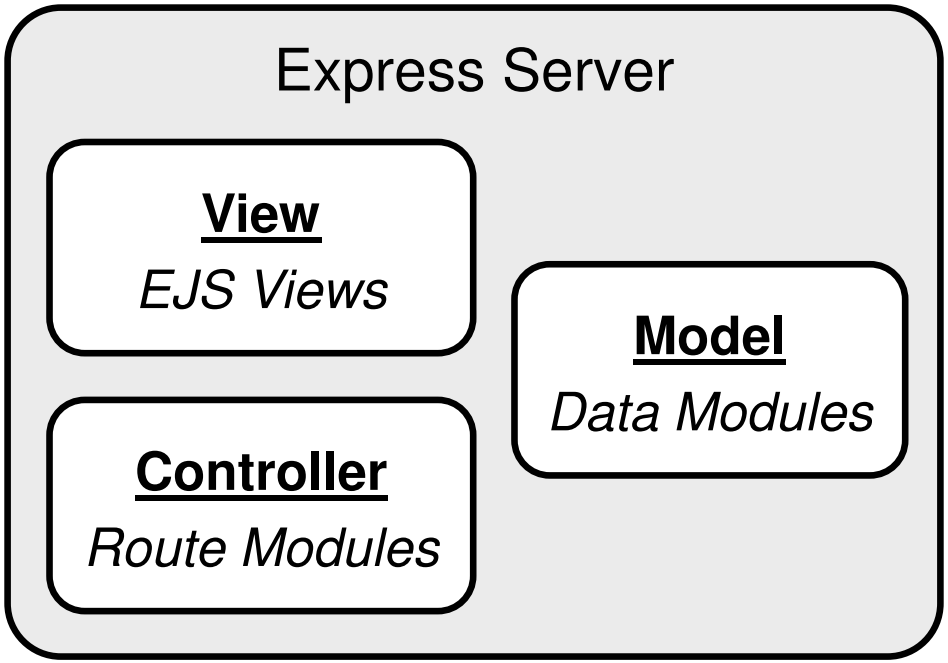
- If the module in the previous slide is called `authentication`, you can set up the Express server like this:

```
const authController =
      require("./authentication");
...
app.post("/signin", authController.signIn);
app.get("/signout", authController.signOut);
```

These two endpoints are handled by the authentication controller

Using MVC in Express

- Based on what we have discussed so far, we can build an example web application using Express



- The application is a stock display system, where you can show the historical stock prices and the corresponding chart of a particular stock

The Stock Application

Enter the stock code

Stock System

Stock Code: FB Show

See the stock prices

FB - Meta Platforms, Inc.

Table View

Show 10 entries

Date	Open	High	Low			
3/31/2022	$228.45	$228.49	$222.26	$222.56	$222.56	24192300
3/30/2022	$228.91	$231.15	$226.71	$227.85	$227.85	25588000
3/29/2022	$226.07	$230.89	$225.29	$229.86	$229.86	31417900
3/28/2022	$222.13	$224.04	$219.54	$223.59	$223.59	26224100
3/25/2022	$220.51	$225.50	$218.89	$221.82	$221.82	40039000
3/24/2022	$215.00	$220.67	$214.79	$219.57	$219.57	31502300
3/23/2022	$213.33	$216.80	$212.16	$213.46	$213.46	23717300
3/22/2022	$211.37	$219.46	$210.18	$216.65	$216.65	31998800
3/21/2022	$214.50	$214.71	$207.63	$211.49	$211.49	30142300
3/18/2022	$206.70	$216.80	$206.00	$216.49	$216.49	52128000

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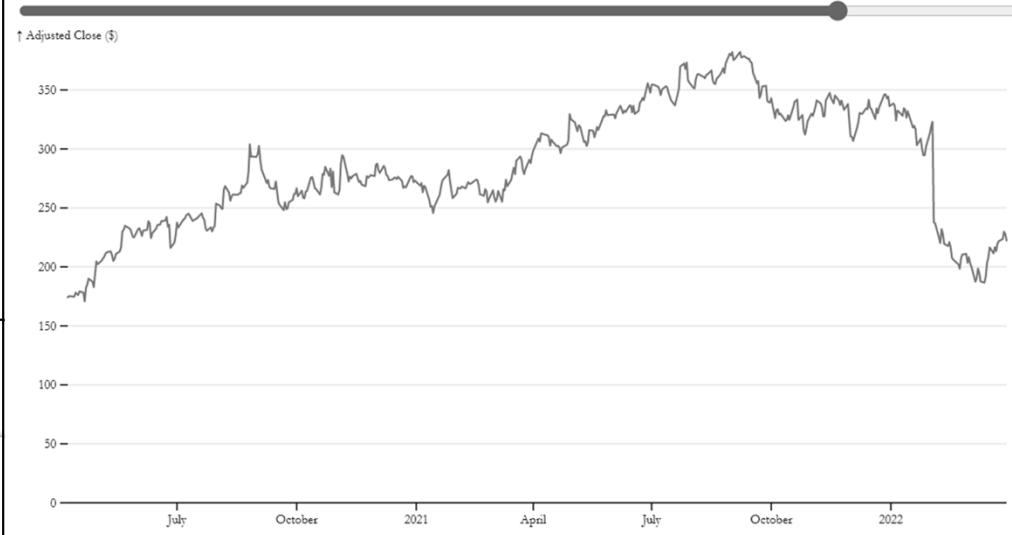
FB - Meta Platforms, Inc. Change Stock

Table View Chart View



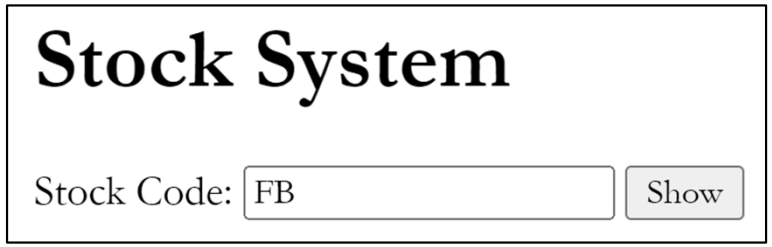
Or, see the stock chart

MVC in the Example

- Here are the components in the stock application:
  - 5 server endpoints
    - ‘`/`’, ‘`/get`’, ‘`/change`’, ‘`/table`’ and ‘`/chart`’
  - 1 model
    - The stocks model
  - 3 views
    - The welcome view, the stock table view and the stock chart view
  - 2 controllers
    - The front page controller and the stock controller

The Server Endpoints 1/2

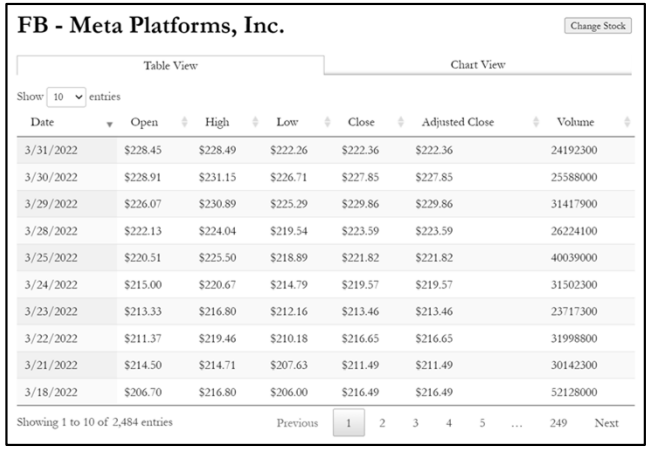
- The '`/`' endpoint
  - Show the welcome page using the welcome view



- The '`/get`' endpoint
  - Load the stock into the session storage
  - Redirect the browser to '`/table`'
  - This does not have a view
- The '`/change`' endpoint
  - Remove the stock from the session storage
  - Redirect the browser to '`/`'
  - This does not have a view

The Server Endpoints 2/2

- The '`/table`' endpoint
  - Show the table view of the stock
  - Redirect the browser to '`/`' if the stock is not loaded
- The '`/chart`' endpoint
  - Show the chart view of the stock
  - Redirect the browser to '`/`' if the stock is not loaded



Date	Open	High	Low	Close	Adjusted Close	Volume
3/31/2022	$228.45	$228.49	$222.26	$222.36	$222.36	24192300
3/30/2022	$228.91	$231.15	$226.71	$227.85	$227.85	25588000
3/29/2022	$226.07	$230.89	$225.29	$229.86	$229.86	31417900
3/28/2022	$222.13	$224.04	$219.54	$223.59	$223.59	26224100
3/25/2022	$220.51	$225.50	$218.89	$221.82	$221.82	40039000
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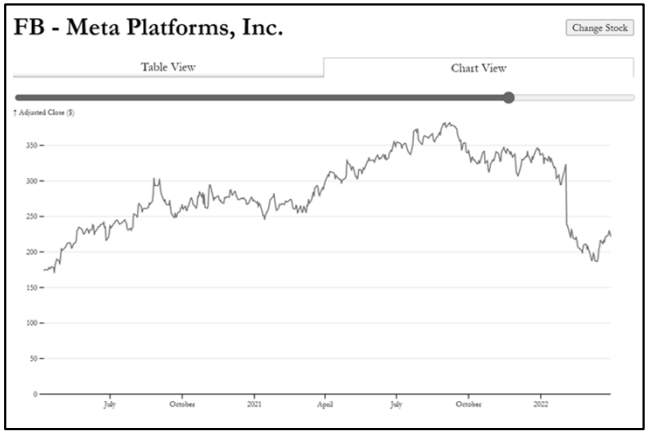
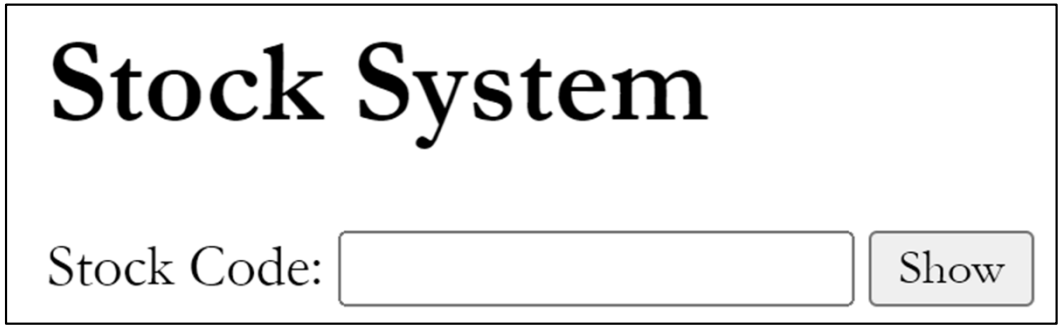
3/23/2022	$213.33	$216.80	$212.16	$213.46	$213.46	23717300
3/22/2022	$211.37	$219.46	$210.18	$216.65	$216.65	31998800
3/21/2022	$214.50	$214.71	$207.63	$211.49	$211.49	30142300
3/18/2022	$206.70	$216.80	$206.00	$216.49	$216.49	52128000



The Welcome View

- The welcome view is a plain HTML page



- If you enter a stock code and press ‘Show’, the form will be submitted to the ‘`/get`’ endpoint
- If no error occurs, you will get to the stock table view page
- Example stock codes are `AAPL`, `FB`, `0001.HK` and `0388.HK`

The Stock Table View

- The stock table view puts the stock prices in an HTML table
- The table is then nicely formatted using the `Datatable` JavaScript library
- You can click on ‘Chart View’ to see the chart (using ‘`/chart`’) or ‘Change Stock’ to switch to another stock (using ‘`/change`’)

0388.HK - Hong Kong Exchanges and Clearing Limited

Change Stock

Table View | Chart View

Show 10 entries

Date	Open	High	Low	Close	Adjusted Close	Volume
3/31/2022	HK$376.00	HK$376.20	HK$369.80	HK$371.40	HK$371.40	4147679
3/30/2022	HK$376.00	HK$383.80	HK$372.40	HK$376.20	HK$376.20	5173799
3/29/2022	HK$375.20	HK$376.80	HK$370.00	HK$372.00	HK$372.00	3072303
3/28/2022	HK$370.40	HK$377.60	HK$367.00	HK$372.40	HK$372.40	3839918
3/25/2022	HK$380.00	HK$385.00	HK$370.80	HK$373.60	HK$373.60	4984150
3/24/2022	HK$380.40	HK$386.60	HK$378.40	HK$384.00	HK$384.00	4285958
3/23/2022	HK$378.00	HK$388.00	HK$378.00	HK$382.80	HK$382.80	5421773
3/22/2022	HK$376.40	HK$381.00	HK$371.80	HK$380.00	HK$380.00	4236957
3/21/2022	HK$382.80	HK$383.00	HK$373.40	HK$374.20	HK$374.20	3817968
3/18/2022	HK$381.60	HK$385.20	HK$373.00	HK$378.60	HK$378.60	6012437

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The Stock Chart View

- The stock chart view shows the chart of a period of the stock

- You can adjust the period using the slider at the top of the chart, which is drawn using the `D3` JavaScript library
- You can switch to see the table view or another stock, similar to the table view

The Controllers

- The front page controller manages only the welcome page of the system, i.e. the ‘/’ endpoint
- The stock controller maintains all other endpoints, which manipulate the stock that you can see from the browser
- Using the controllers, the Express app can be set up concisely, as the application logic is inside the controllers

Summary

- Using MVC, you can separate your code into models, views and controllers
- This allows you to focus on one aspect of the project, rather than mixing them all together
- It is not only useful in Express, but also in other client-side or server-side frameworks