COMP4021
Internet Computing

# A SPA Example

Gibson Lam

# A Basic SPA Example

- In this presentation, we will take a look at a basic single-page application example
- It is a web page for managing students

## Students Manager

| Student Id | Name | Year of Study | Action |
|---|---|---|---|
| 20000000 | Chan Mei Ho | 3 | Change Delete |
| 20000001 | Chan Tai Man | 3 | Change Delete |
| 20000002 | Kwan Siu Lai | 4 | Change Delete |
| 20000003 | Poon Lik Hang | 4 | Change Delete |
| Enter Student Id | Enter Name | Enter Year of Study | + |

# Files in the Example

- The example has three files:
  - `manager.html`
    The frontend HTML page of the application

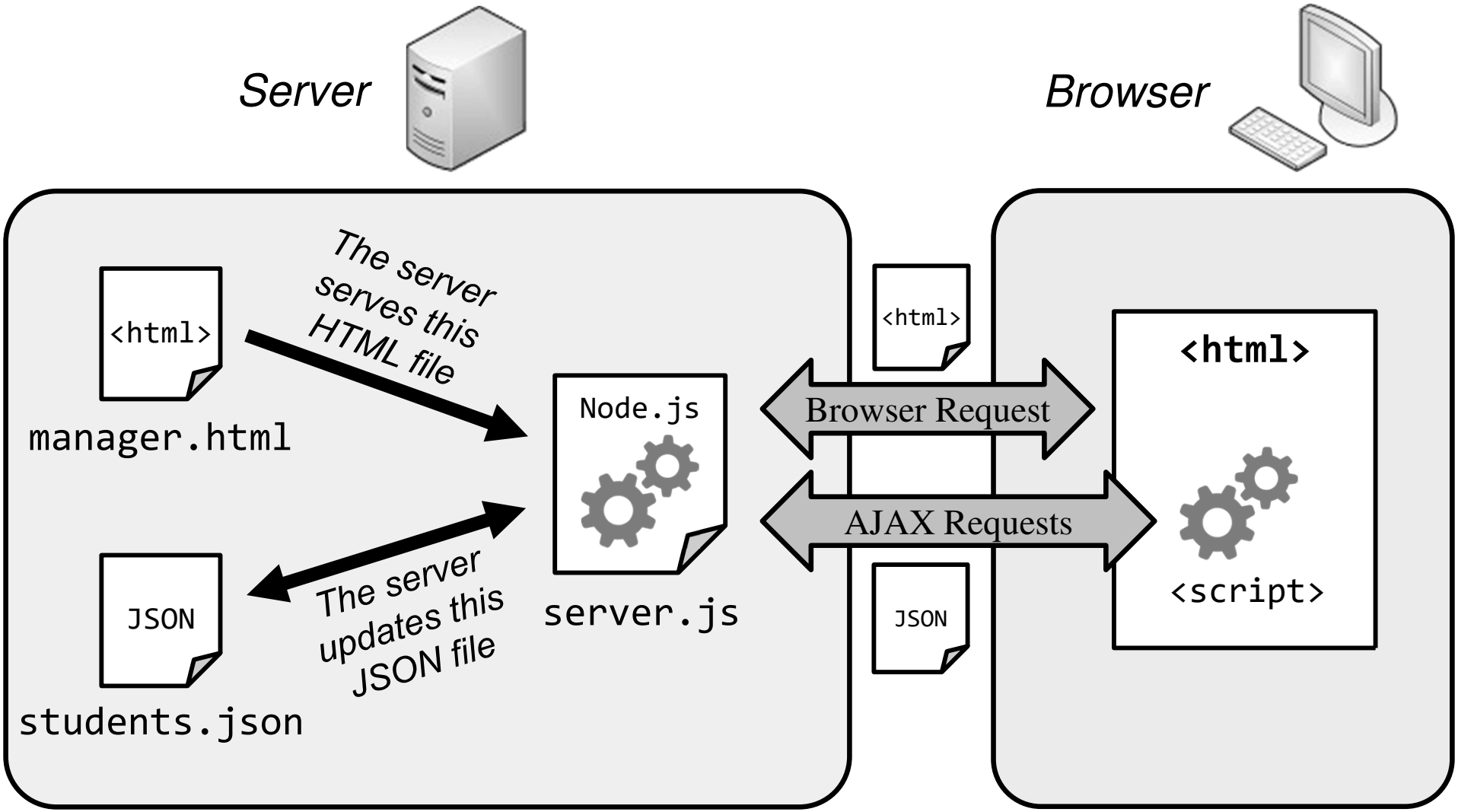
*Browser*

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

  - `server.js`
    The server program that contains the web server of the application
  - `students.json`
    The JSON data of the students residing on the server

*Server*

# System Overview



# The HTML Page

- The HTML page has a table that shows the current students in the system

**Students Manager**

| Student Id | Name | Year of Study | Action |
|---|---|---|---|
| 20000000 | Chan Mei Ho | 3 | Change Delete |
| 20000001 | Chan Tai Man | 3 | Change Delete |
| 20000002 | Kwan Siu Lai | 4 | Change Delete |
| 20000003 | Poon Lik Hang | 4 | Change Delete |
| Enter Student Id | Enter Name | Enter Year of Study | + |

- You can change or delete individual students, or add new ones
- All of these are accomplished by sending AJAX requests to the server, without ever leaving the page

# Using the Page

## Students Manager

| Student Id | Name | Year of Study | Action |
|---|---|---|---|
| 20000000 | Chan Mei Ho | 3 | Change Delete |
| 20000001 | Chan Tai Man | 3 | Change Delete |
| 20000002 | Kwan Siu Lai | 4 | Change Delete |
| 20000003 | Poon Lik Hang | 4 | Change Delete |
| Enter Student Id | Enter Name | Enter Year of Study | + |

*Add a new student by filling in the information and then click on '+'*

*Change the information and click on 'Change' or delete a student by clicking on 'Delete'*

# Sending AJAX Requests

- All requests are sent using `fetch()`
- For example, to get the current students, this code is used:

*The server path to get the students*

```
fetch("/students/all")
    .then((response) => response.json())
    .then((students) => {
        ...Add the students
            in the table...
    });
```

# GET and POST Requests

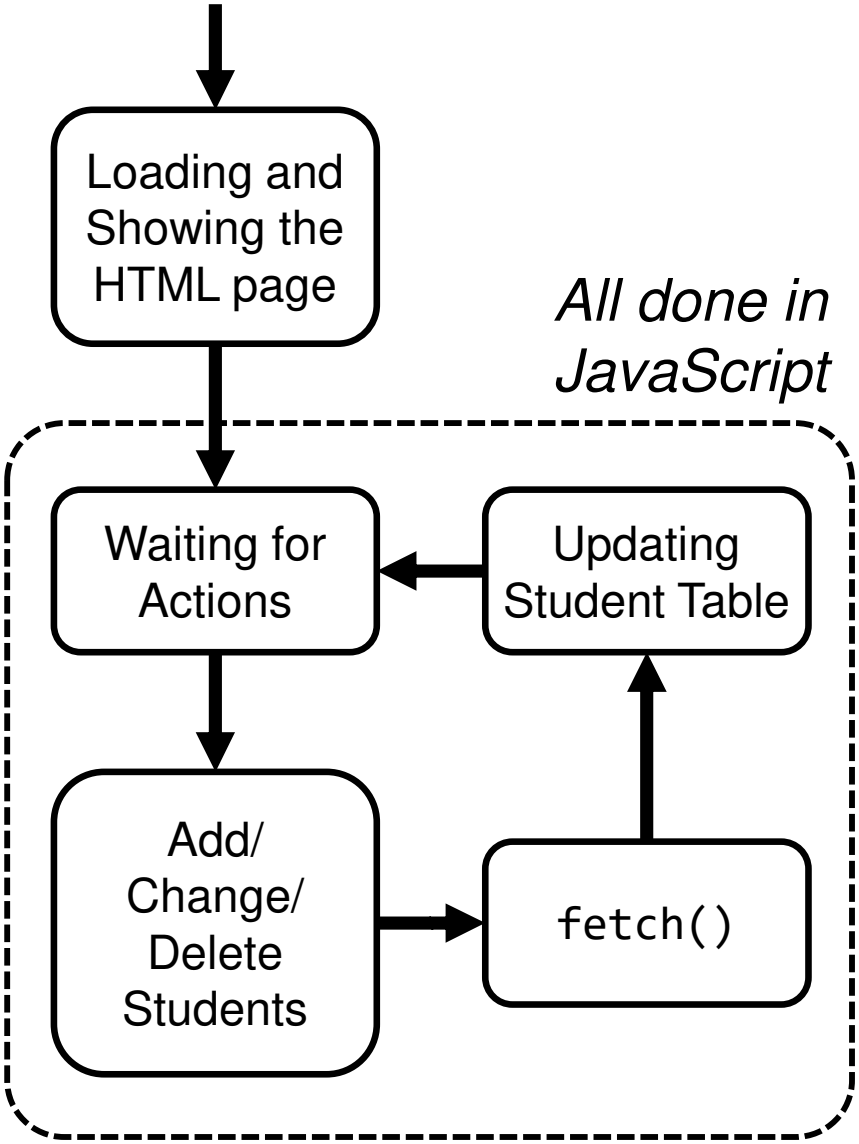
- The previous example uses a GET request
- The other requests are POST requests as JSON data are sent to the server, e.g.:

```
fetch("/students/add", {
    method: "POST",
    headers: {"Content-type": "application/json"},
    body: JSON.stringify({ id, name, year })
})
  .then((response) => response.json())
  .then((result) => { ... });
```

*JSON data is sent to the server in the 'add student' request*

# Updating the Student Table

- The HTML page makes requests to add, change or delete students
- Whenever changes are made, the HTML page updates the entire student table, i.e. `<table>…</table>`



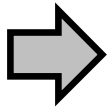
# Adding HTML Using jQuery

- jQuery allows you to quickly add HTML by doing something like this:

```
$(...Parent...).append($("... HTML..."));
```

- For example, you can append a header to the end of the body using this code:

```
<html>
 ▶ <head>…</head>
   <body></body>
</html>
```



```
<html>
 ▶ <head>…</head>
 ▼ <body>
     <h1>Hi!</h1>
   </body>
</html>
```

```
$("body").append($("<h1>Hi!</h1>"));
```

20000000 | Chan Mei Ho | 3 | Change | Delete

# Inserting a Student

- The following code inserts a student into the table body:

```
▼<tr>
  <td>20000000</td>
  ▼<td>
    <input id="name-20000000" value="Chan Mei Ho">
  </td>
  ▼<td>
    <input id="year-20000000" value="3">
  </td>
  ▼<td>
    <button class="change" data-id="20000000">Change</button>
    <span> </span>
    <button class="delete" data-id="20000000">Delete</button>
  </td>
</tr>
```

*An example in Chrome*

```
const student = $("<tr></tr>")
    .append($("<td>" + id + "</td>"))
    .append($("<td><input id='name-" + id + "' value='" +
              name + "'></td>"))
    .append($("<td><input id='year-" + id + "' value='" +
              year + "'></td>"))
    .append($("<td></td>")
        .append($("<button class='change' data-id='" + id +
                  "'>Change</button>"))
        .append($("<span> </span>"))
        .append($("<button class='delete' data-id='" + id +
                  "'>Delete</button>"))
    );
$("#table-body").append(student);
```

*append() can be chained for jQuery objects*

# The Server Endpoints

- Here are the specifications of the server endpoints, i.e. available access paths in the server:

| **Method** | **Path** | **Request Body** | **Response Body** |
|---|---|---|---|
| GET | /students/all | - | JSON of students, e.g.<br>`{`<br>`  id: {name, year},`<br>`  ...`<br>`}` |
| POST | /students/add | `{id, name, year}` | `{ success: true }`, or<br>`{ error: "..." }` |
| POST | /students/change | `{id, name, year}` | `{ success: true }`, or<br>`{ error: "..." }` |
| POST | /students/delete | `{id}` | `{ success: true }` |

# The Students JSON File

- The JSON file `students.js` is the ‘database’ of the application
- It stores the students in simple JSON format, as shown on the right:

```
{
  "20000000": {
    "name": "Chan Mei Ho",
    "year": 3
  },
  "20000001": {
    "name": "Chan Tai Man",
    "year": 3
  },
  ...More students here...
}
```

# Using the File System Module

- On the server program, the JSON file is read every time a request is made
- If there are changes to the students, the data will be written back the file
- The `fs` (file system) module is needed to read and write files, which is imported by:

```
const fs = require("fs");
```

# Reading and Writing Files

- The application uses `fs.readFileSync()` and `fs.writeFileSync()` to read and write files respectively
- There are also asynchronous, promise version of the two commands
- In this example, we use the synchronous functions to keep things simple but they may block the server execution if the JSON file is very large

# Dealing With the JSON Files

- Here is the code to read and write the JSON file:
  - Reading

```
const students =
    JSON.parse(fs.readFileSync("students.json"));
```

*Convert to a JavaScript object before using*

  - Writing

*Add spacing to the JSON content*

```
fs.writeFileSync("students.json",
    JSON.stringify(students, null, "  "));
```

*Convert to JSON content before writing*

# The Get-Students Endpoint

- The code for the get-students endpoint does two things:
  1. Reading the JSON file
  2. Returning the `students` object as JSON data

```
app.get("/students/all", (req, res) => {
  const students =
    JSON.parse(fs.readFileSync("students.json"));

  res.json(students);
});
```

1

2

# The Add-Student Endpoint

- The add-student endpoint does a bit more, which includes:
  1. Reading the JSON body
  2. Checking for duplicate id
  3. Adding the student and writing the JSON file

```
app.post("/students/add", (req, res) => {
  1 const { id, name, year } = req.body;

    const students = JSON.parse(...);

  2 if (students[id]) {
      res.json({ error: "..." });
      return;
    }

  3 students[id] = { name, year };
    fs.writeFileSync(...);

    res.json({ success: true });
  });
```

*Return an error message*

# The Change/Delete Endpoints

- The change-student and delete-student endpoints are almost the same as the add-student endpoint
- The delete-student endpoint uses the `delete` keyword to delete a student in the `students` object, i.e.:

```
delete students[id];
```

where `id` is a key in the JavaScript object

# Summary

- This example demonstrates the use of AJAX `fetch()` and a Node.js server to build a basic single-page application
- It does not have strict data validation so you may be able to break the system using some weird input values
- Nevertheless, this will be a good starting point for the work that you will do later in the server-side labs