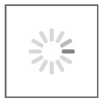
Front End Considerations

When calling services

- What does the Front End need to consider?

The Biggest Lie in Web Dev



- We use "spinners" to tell the user to wait
- Does NOT indicate actual computer activity

Using a Spinner

- Add to page before starting a (long?) async action
- Remove when complete
- If something breaks and you don't remove it
- ...it keeps spinning
- ...does NOT indicate anything is "thinking".
- It is just an animated image

Spinner Example

```
appEl.addEventListener('click', (e) => {
  if( e.target.classList.contains('show-cats') ) {
    state.isLoadingCats = true;
    render();  // Shows spinner
    fetchCats()  // Starts async
      .then( cats => {   // Runs after fetch delay
        state.cats = cats;
        state.isLoadingCats = false;
        render(); // shows data, not spinner
      })
      .catch( err => {
        state.error = err;
        state.isLoadingCats = false;
        render(); // shows error, not spinner
      });
  }
});
```

What is the Spinner?

- Can be image
    - With or without CSS to "spin"
- Can be text (Ex: `Loading...`)
- Can be pure CSS
    - **https://css.gg/app?s=spinner**

When to show Spinner/Loading Indicator

- To signal user that something is coming
- Async calls can take surprising time!
- Don't show misleading state
- Users get
    - Frustrated
    - Confused
    - And worst, BORED
        - Start clicking
- May show one spinner for multiple loads
    - Rather than many small spinners

Separating Service Call Concerns

Complexity can drag your code down

- Hard to find bugs
- Hard to fix bugs
- Hard to add features

Write it clean from the start

- Good, meaningful names
- Keep concerns separate

Example HTML for poor JS coding

Sample HTML for a simple TODO list

```
<ul class="tasks">
  <li class="task">Do INFO6250 work ONTIME</li>
</ul>

<div class="to-add">
  <input name="taskName" class="task-to-add">
  <button class="add-task">
</div>
```

Example of poor service call, part 1

```javascript
const addButton = document.querySelector('.add-task');
addButton.addEventListener('click', (e) => {
  e.preventDefault();
  const taskText = document.querySelector('.task-to-add');
  addButton.innerText = "...";
  addButton.disabled = true;
  fetch('/tasks', {
    method: 'POST',
    headers: new Headers({
      'content-type': 'application/json'
    }),
    body: JSON.stringify({ text: taskText });
  })
  //...more stuff
```

What needs to happen?

- Attach an event listener
- Indicate call in-progress (spinner)
- ...here "..." text and disabled
- Read in data from form/input fields
- Send call
- Handle errors, OR
- Read results
- ...This will be a full list of tasks
- ...including the new one
- Update list of tasks
- Clear the form/input fields

First Problem

That's a lot!

...So do not try to do it all in one function!

Fixing that issue (but not everything)

```
const addButton = document.querySelector('.add-task');
addButton.addEventListener('click', (e) => {
  e.preventDefault();
  adjustButton(addButton);
  const formData = gatherFormInfo();
  addTask(formData, addButton);
});
```

This is more readable, but doesn't FIX the problems

- we pass `addButton` to `addTask()` to reset the button text/state
- But `addTask()` still coupled to the HTML
    - Still has to set the list
    - Has to report errors

Better separation

```
const addButton = document.querySelector('.add-task');
const taskList = document.querySelector('.tasks');

addButton.addEventListener('click', (e) => {
  e.preventDefault();
  const origText = setSpin({button: addButton, spin: true});
  const formData = gatherFormInfo();
  addTask(formData)
  .then( taskList => {
    refreshList(taskList);
    resetNewTaskInput();
  })
  //...
});
```

Why/How is this better?

The real change is not here, it is inside `addTask`

- `addTask()` no longer touches ANY html
- It is given data, returns data
- Errors are rejected as data
- Caller can decide how to react to this data
- Can be reused for different purposes!
- Does not change if the HTML changes!

That is the "Separation" in "Separation of Concerns"

Here's the rest of calling addTask

Notice `.fetch()` is **inside** `addTask()`

```
  addTask(formData)
  .then( taskList => {
    refreshList(taskList);
    resetNewTaskInput();
  })
  .catch( err => {
    reportError(err);
  })
  .then( () => {
    setSpin({
      button: addButton, text: origText, spin: false
    });
  });
});
```

But using **results** are **outside** `addTask()`

Details

Some things required an extra step

- "spinner" was done before fetch and after .catch()

Most parts got easier!

- Doing less means fewer things to worry about!

And it all makes more sense

- All changes to HTML in the event handler

You want to minimize "side-effects"

- Code is more reusable
- Know what functions do without looking at code

A well-written service call

- sends/gets data

That's all

That involves translating data (incl errors)

- Not reading data from HTML
- Not displaying data
- Not displaying errors

Promises make it easy to attach behaviors

- **IF** you return the promise!

Sample addTask

Notice we **return** the promise

- We don't add any behavior except data parsing/translation

```
function addTask( { taskText } ) {
  return fetch( '/tasks',
    method: 'POST',
    headers: new Headers({
      'content-type': 'application/json'
    }),
    body: JSON.stringify({ text: taskText });
  })
  // ...the rest
};
```

Parsing the response

There is not ONE way

```
//...the fetch call
.catch( err => Promise.reject('Network issues'))
.then( response => {
  if(response.ok) {
    return response.json();
  }
  return Promise.reject(response.statusCode);
})
// ...returned to caller
```

Here our errors are unstructured

- Always good to provide structure

Structured Errors Example

```
//...the fetch call
.catch( err => {
  return Promise.reject({error: 'networkError'});
});
.then( response => {
  if(response.ok) {
    return response.json();
  }

  return response.json()
  .then(serviceData => {
    return Promise.reject({
      error: `status${response.statusCode}`,
      details: serviceData,
    });
  });
})
// ...returned to caller
```

Errors reject with predictable structure

Code "Responsibility"

- Consider "the responsibility" of some code
    - Don't change values outside responsibility
    - Pass in needed values outside responsibility
- Ex: functions that fetch and transform results
    - return promise of results or error
    - Separate concerns of "getting data" and "displaying data"
- Ex: structured Errors
    - Separate concerns of "deciding error" and "handling error"

Client - Server Synchronization

- The server is the source of truth
- State on the client
    - potentially out of date
- Double state-changing actions
    - Double-click on button?

Why does it matter?

- Deleting an element already gone?
    - VERY BAD if using array index!
        - Delete unintended element
- Increment/Decrement too much?
- Pay $ based on inaccurate total?
    - Pay twice?
- Overwrite values on server?

Options to deal with data desync?

"Correct" answer depends on app

- Just trust the client
    - Make user responsible for knowing
- Keep a hash/timestamp of state
    - When client sends wrong value
        - Server refuses certain actions

Updating Client After Action

When do you update client state

- To be more likely in-sync with server?

Important to consider after sending a change

- Updates mean loading time!

Example:

- Load list from server
- Tell server to delete an item?
- Do you delete the item in the local state?
- Do you reload the list from server?

The "Back" Button

A SPA has issues with the browser "Back" button

- SPA is a single changing page
- "Back" completely leaves that page
- "Forward" reloads the page
- State before you hit "Back" is lost

This is a notable problem!

- But we will ignore until React
    - Solutions don't require React
- "Deeplinking" will be the solution

Long Results

Too much data to show user at once

- Option 1: Pagination of Results
- Option 2: Infinite Scroll

Results Pagination

- Like with service, but visible on screen
- Specific page numbers
    - And/Or "Previous"/"Next"
- Changes shown data
    - May or may not have to RETRIEVE data
    - May have more data than shown
        - Ex: Already have prev/next pages data
        - Show immediately on change
            - Start loading NEW data
            - Creates impression of speed

Infinite Scroll

- As user approaches end of displayed content
    - (scrolling)
    - Load additional data
    - Append to HTML
- May need to "remove" HTML from top
    - Otherwise it gets slow
- Accessibility problems
- Hard to save/link where you are at
- Best to use only on temporary data

Polling for Updates

The web request/response cycle:

- means the client has to ASK for an update
- ...even if there isn't one yet

This can feel (and be) inefficient

- But is also very common
- We'll do periodic polling because it's simple
- ...not because it is better

Polling methods

- Periodic Polling ("Basic", "Regular")
    - Periodic web requests
- "Long Polling"
    - Server keeps res open
    - Server finishes res once there is an update
    - Client immediately opens new request
        - On success or error
- Websockets
    - Not HTTP
    - A different protocol started *from* HTTP
    - Allows server "push" actions

Long Polling

- Client makes request
    - "Give me updates" vs "Are there updates"
- Server does NOT respond right away
    - Once it has an update, will respond
- Client auto times out connection (2-5 mins?)
    - Client will try again
- When Client gets response with data
    - Use data
    - Make new long polling request

All Client request behavior is in JS code

- Not automatic

Websockets

- Not HTTP: `ws://`, `wss://`
    - JS code requests a WebSocket connection
    - From server, with `ws` url
- Longer-lasting connection
- Not request/response
- Allows server to send unprompted messages
    - Once connection exists

Regular Polling

All I expect for this course

Pros

- Easy to implement
- Easy to understand

Cons

- Generates a lot of requests

`setTimeout()`

```
const timeoutId = setTimeout(callback, milliseconds);
```

- Calls passed **callback**
- No sooner than **milliseconds** from now
    - But could take longer (event queue!)
- Returns a `timeoutId`
    - Used by `clearTimeout(timeoutId)` to cancel

`setInterval()`

```
const intervalId = setInterval(callback, msecs);
```

- Very similar to `setTimeout()`
    - Call callsback
- But repeats *every* msecs (ish)
    - Not just once
- canceled by `clearInterval(intervalId);`

Implementing Regular Polling

- use `setInterval()` or `setTimeout()`
    - `setTimeout()` must schedule next run
    - `setInterval()` automatically schedules
        - Watch out for results taking too long
            - Coming back in wrong order
- **callback** issues a `fetch()`
    - and sets callbacks for `.then()`

Regular Polling Example

```
function refreshCats() {
  fetchCats()
  .then( cats => {
    state.names = cats;
    render();
  })
  // omitted error reporting for space
}

function pollCats() {
  refreshCats(); // fetch and use data
  setTimeout( pollCats, 2000 );
}
```

CORS on Client-side

Request a Cross-Origin Service is easy

- Just use URL with a different origin
- Browser enforces CORS
- Server is responsible for including CORS headers

When you get a CORS error

Use DevTools-Network

- Confirm URL is correct
- Confirm Server sent a success
- Check Response has CORS headers
- Fix Request or Server

Don't waste time trying to "turn CORS off"

- Don't use "no-cors"

Cookies not sent by default when Cross-Origin

- `fetch()` must use `credentials: include` option
  - Will silently not send cookies otherwise
  - Only client-side control we have for this
- Cookie NOT created with `SameSite=Strict` option
  - Default is `Lax`, which does work
- Service must send `access-control-allow-credentials: true` header
  - Otherwise browser will give CORS error when credentials sent