REST

Overview

- Stands for **RE**presentational **S**tate **T**ransfer
- An architectural style, not a standard or API
- Described in Roy Fielding's dissertation in 2000 (chapter 5)
  - http://www.ics.uci.edu/~fielding/pubs/dissertation/top.htm
- Main ideas
  - a software component requests a "**resource**" from a service
    - by supplying a resource identifier and a desired media type
    - resource identifier can be a URL and request can be made using Ajax
  - a "**representation**" of the resource is returned
    - a sequence of bytes and metadata to describe it (can be JSON; name/value pairs in HTTP headers, ...)
    - can contain identifiers of other resources
  - obtaining this representation causes the software component to "**transfer**" to a new "**state**"

Typical REST

- Relies on HTTP
- Uses carefully selected URLs to identify resources
- Uses HTTP methods for specific operations

a.k.a. HTTP verbs

primarily for Create-Retrieve-Update-Delete (**CRUD**) operations

  - **GET** - retrieves representation of existing resource identified by URL
  - **POST** - creates a new resource using data in body
    - URL of new resource is not yet known
    - often the URL of the request identifies an existing parent resource
    - return URL of new resource in **Location header** and **status 201 Created**

ex. POST to URL for a music artist, supplying data describing a new CD; URL of new CD resource is returned

  - **PUT** - updates existing resource identified by URL using data in body
    - URL of resource is already known
    - like POST, body contains entire description of resource
    - can also create a new resource if its URL is already known
  - **PATCH** - like PUT, but body only describes changes
    - other properties retain their current value
  - **DELETE** - deletes existing resource identified by URL
  - **POST** - for everything else (non-CRUD operations)

Idempotent

- Means doing something multiple times is no different than doing it once
  - in REST this applies to server-side state and responses
- GET, PUT, and DELETE requests should be idempotent
  - it's possible for data returned by repeated GET requests to differ,
    but the differences shouldn't be caused by processing the GET request
- POST requests are not necessarily idempotent
  - each request can cause different changes to server state
    based on the state at the time the request is processed
  - POST examples
    - can create a new resource and each can be assigned a different identifier
    - can order an item; remaining inventory changes, so subsequent requests can fail
- These rules aren't enforced,
  but violating them goes against HTTP specification

Ajax

- REST calls are made from web clients using Ajax
- Can use low-level `XMLHttpRequest` approach
- Typically a library is used instead
- Many choices
  - Fetch, axios, superagent, jQuery, ...
- We'll focus on Fetch

Fetch API

- "The Fetch Standard defines the `fetch()` JavaScript API,
  which exposes ... networking functionality
  at a fairly low level of abstraction."
- A Web Hypertext Application Technology Working Group (WHATWG) standard
  - https://fetch.spec.whatwg.org/
- Browser support
  - Chrome, Firefox, Edge, and Safari, but not IE

Fetch Polyfill

- https://github.com/github/fetch
- Works in IE9+
- To install
  - `npm install --save whatwg-fetch`
- To make `fetch` function available globally
  - `import 'whatwg-fetch';`
- HTTP method names can be lowercase
  - except for `PATCH`, so just make all uppercase to avoid confusion

GET

- To send a GET request to obtain text

```
try {
  const res = await fetch(restUrl);
  const text = await res.text();
  // Do something with text.
} catch (e) {
  // Handle error.
}
```

assumes in an **async** function

- To send a GET request to obtain JSON

```
try {
  const res = await fetch(restUrl);
  const obj = await res.json();
  // Do something with obj.
} catch (e) {
  // Handle error.
}
```

assumes in an **async** function

DELETE

- To send a DELETE request

```
try {
  await fetch(restUrl, {method: 'DELETE'});
  // Do something after
  // successful delete.
} catch (e) {
  // Handle error.
}
```

assumes in an **async** function

POST/PUT/PATCH Text

- To send a POST (or PUT or PATCH) request with a text body

```
try {
  const res = await fetch(restUrl, {
    method: 'POST',
    headers:{'Content-Type': 'text/plain'},
    body: text
  });
  // Do something with success response.
} catch (e) {
  // Handle error.
}
```

assumes in an **async** function

POST/PUT/PATCH JSON

- To send a POST (or PUT or PATCH) request with a JSON body

```
try {
  const res = await fetch(restUrl, {
    method: 'POST',
    headers:{'Content-Type': 'application/json'},
    body: JSON.stringify(obj)
  });
  // Do something with success response.
} catch (e) {
  // Handle error.
}
```

assumes in an **async** function

can also send a POST with no body

can also add **Accept** header to describe acceptable response MIME types

Fetch Caveats

- From polyfill documentation
  - "The Promise returned from `fetch()`
    won't reject on HTTP error status
    even **if** the response is a HTTP **404 or 500**.
    Instead, it **will resolve normally**,
    and it **will only reject on network failure**,
    or if anything prevented the request from completing."

check `res.status`
or `res.ok`
in success handler

  - "**By default**, fetch **won't send any cookies to the server**,
    resulting in unauthenticated requests
    if the site relies on maintaining a user session."
    - "**To automatically send cookies** for the current domain,
      the credentials option must be provided"

Making Fetch Easier ...

- Using some utility functions helps
- Recommend placing these in **`fetch-util.js`** and importing where needed

```
// Change this to match the URL prefix of your REST services.
// If your project uses REST services with more than one URL prefix,
// drop use URL_PREFIX and just pass full URLs into the functions.
const URL_PREFIX = 'http://localhost:1234/';

// If there are any common options that are
// desired in all HTTP requests, place them here.
const options = {};

// Can't name this "delete" because that is a JavaScript keyword.
export async function deleteResource(urlSuffix) {
  const url = URL_PREFIX + urlSuffix;
  return fetch(url, {...options, method: 'DELETE'});
}
```

… Making Fetch Easier …

```
export async function getJson(urlSuffix) {
  const url = URL_PREFIX + urlSuffix;
  const res = await fetch(url, options);
  if (!res.ok) throw new Error(await res.text());
  return res.json();
}

export async function getText(urlSuffix) {
  const url = URL_PREFIX + urlSuffix;
  const res = await fetch(url, options);
  if (!res.ok) throw new Error(await res.text());
  return res.text();
}
```

`method` defaults to `'GET'`

... Making Fetch Easier

```
export function postJson(urlSuffix, obj) {
  return postPutJson('post', urlSuffix, obj);
}

export function putJson(urlSuffix, obj) {
  return postPutJson('PUT', urlSuffix, obj);
}

export function postPutJson(method, urlSuffix, obj) {
  const url = URL_PREFIX + urlSuffix;
  const headers = {'Content-Type': 'application/json'};
  const body = JSON.stringify(obj);
  const res = fetch(url, {...options, method, headers, body});
  return res.json();
}
```

Exercise ...

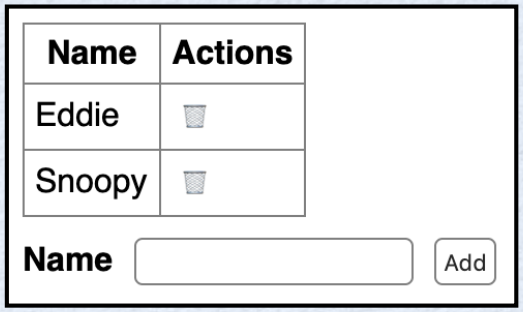
- Modify dog app to use supplied REST services
- Add **<th>** for Actions column

```
<th>Actions</th>
```

- Add **<td>** in each dog row

```
<td>
  <button @click="() => deleteDog(dog.id)">&#x1f5d1;</button>
</td>
```

unicode trashcan



- Get dogs in **mounted** method
- Modify **addDog** method to send POST request to add dog
- Add **deleteDog** method that sends DELETE request to delete dog
- Solutions on last slide
- It's helpful if you know about JavaScript **async/await**

.. Exercise

- Supplied REST services
  - implemented with Node.js and Express
  - **`GET /dog`** - retrieves all dogs
    - response body contains JSON array of dog objects
  - **`DELETE /dog/{id}`** - deletes a dog
  - **`POST /dog`** - creates a dog
    - request body contains dog name
    - response body contains JSON dog object
- Supplied code is on next slide
- To start server
  - **`cd server`**
  - **`npm install`** (first time only)
  - **`npm run start`**

Node Express Server

server.js

```
const bodyParser = require('body-parser');
const cors = require('cors');
const express = require('express');
const morgan = require('morgan');

const app = express();
app.use(morgan('short'));
app.use(bodyParser.text());
app.use(cors());

const dogMap = {};
let lastId = 0;

function addDog(name) {
  const id = ++lastId;
  const dog = {id, name};
  dogMap[id] = dog;
  return dog;
}

addDog('Eddie');
addDog('Snoopy');
```

```
app.get('/dog', (req, res) => {
  res.send(Object.values(dogMap));
});

app.delete('/dog/:id', (req, res) => {
  const {id} = req.params;
  const found = Boolean(dogMap[id]);
  if (found) delete dogMap[id];
  res.sendStatus(found ? 200 : 404);
});

app.post('/dog', (req, res) => {
  const name = req.body;
  res.send(addDog(name));
});

app.listen(1919, () => console.log('ready'));
```

Exercise Solutions ...

```
async mounted() {
  try {
    const res = await fetch(REST_URL);
    this.dogs = sortDogs(await res.json());
  } catch (e) {
    console.error('error getting dogs:', e.message);
  }
},
```

```
async addDog() {
  // If a dog with that name is already present, do nothing.
  const exists = this.dogs.some(dog => dog.name === this.name);
  if (!exists) {
    try {
      const res = await fetch(REST_URL, {method: 'POST', body: this.name});
      const dog = await res.json();
      this.dogs = sortDogs(this.dogs.concat(dog));
    } catch (e) {
      console.error('error adding dog:', e.message);
    }
  }

  this.name = '';
},
```

… Exercise Solutions

```
async deleteDog(id) {
  const url = REST_URL + '/' + id;
  try {
    await fetch(url, {method: 'DELETE'});
    this.dogs = this.dogs.filter(dog => dog.id !== id);
  } catch (e) {
    console.error('error deleting dog:', e.message);
  }
}
```