

The image features a minimalist design with a central horizontal band of medium blue color. This band is flanked by two sections of light gray, one above and one below. The word "REST" is centered within the blue band in a dark gray, sans-serif font.

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.”
  - “**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”

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



# 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`

Name	Actions
Eddie	
Snoopy	

Name



# .. 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);  
  }  
}
```