Client-Side Web Programming: JavaScript (Part 3)

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Objectives

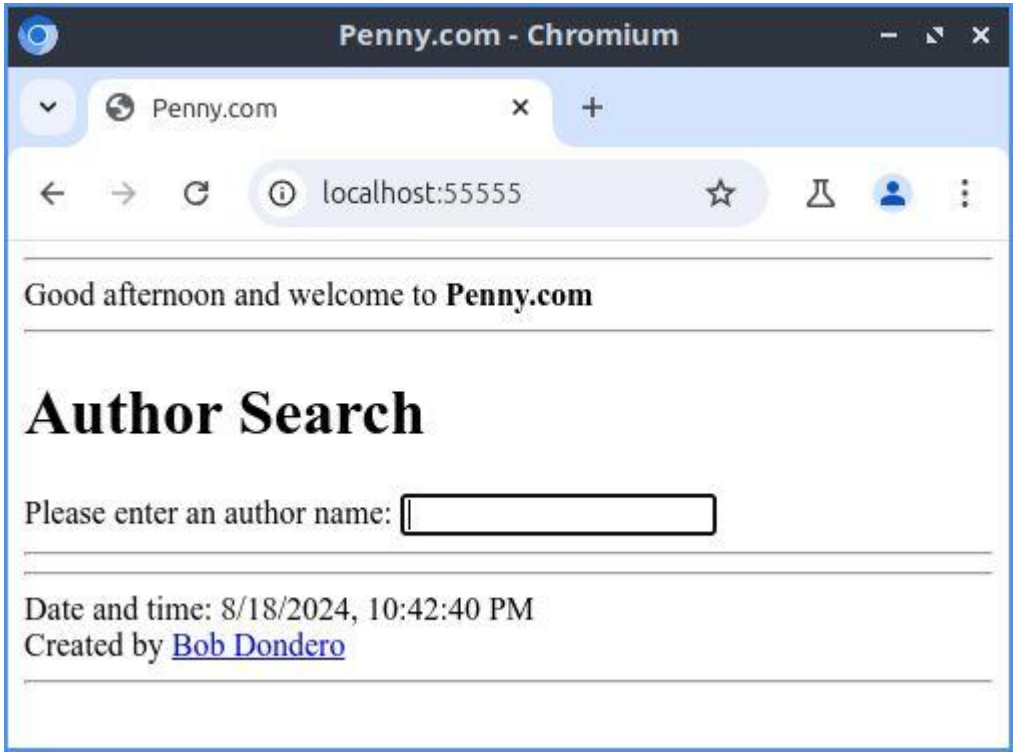
- We will cover:
  - The JavaScript Mustache template engine
  - JavaScript libraries for client-side web programming
  - jQuery

Agenda

- **Review**
- AJAX enhancement 2
- AJAX enhancement 3
- AJAX wrap-up
- JavaScript libraries
- jQuery

Review

- Recall **PennyAjax2** app



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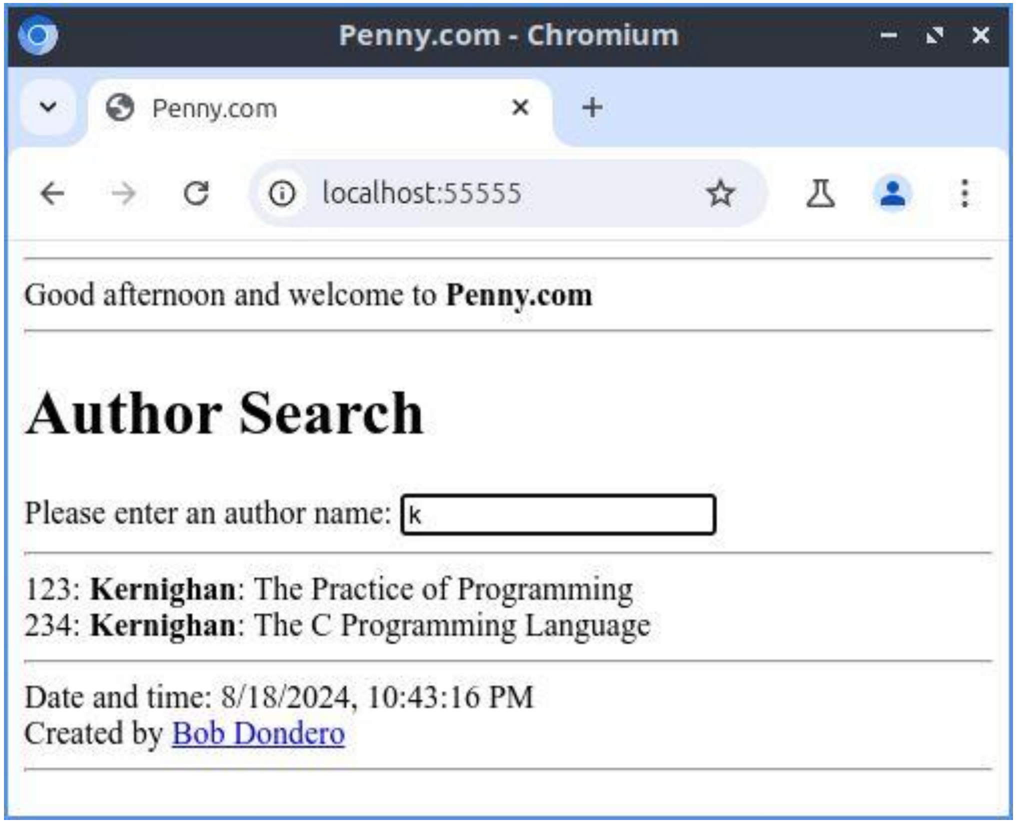
No
“Go”
button

Review

- Recall **PennyAjax2** app (cont.)



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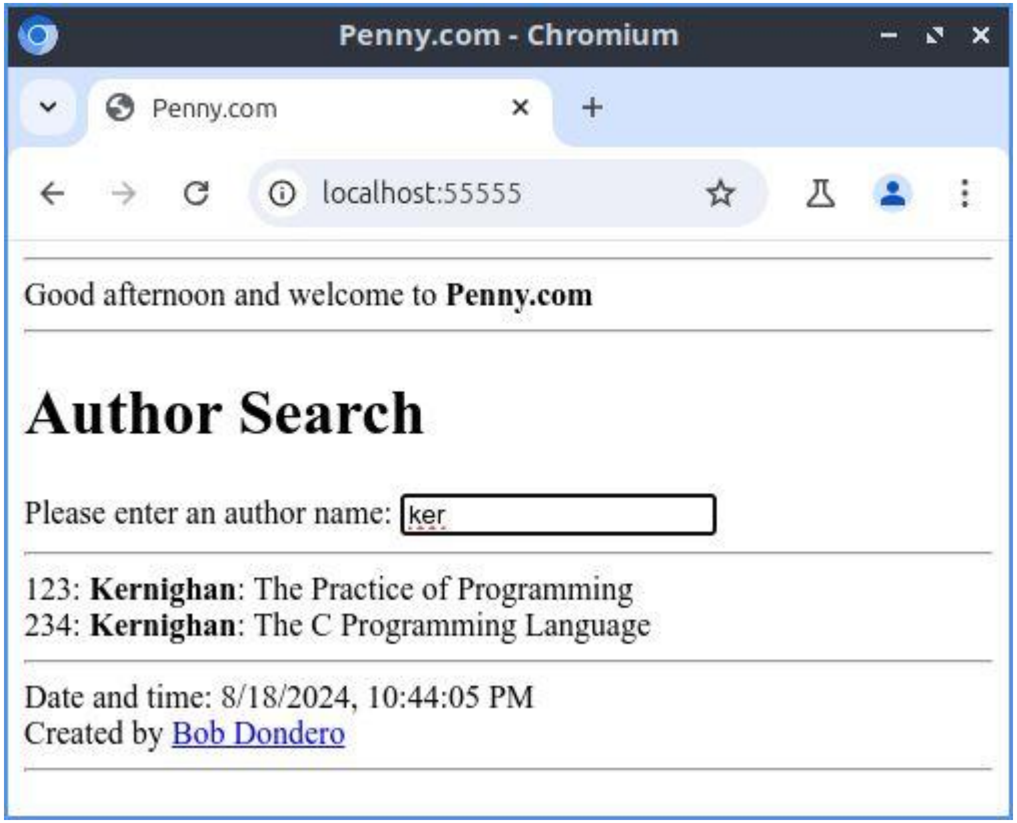
Review

- Recall **PennyAjax2** app (cont.)



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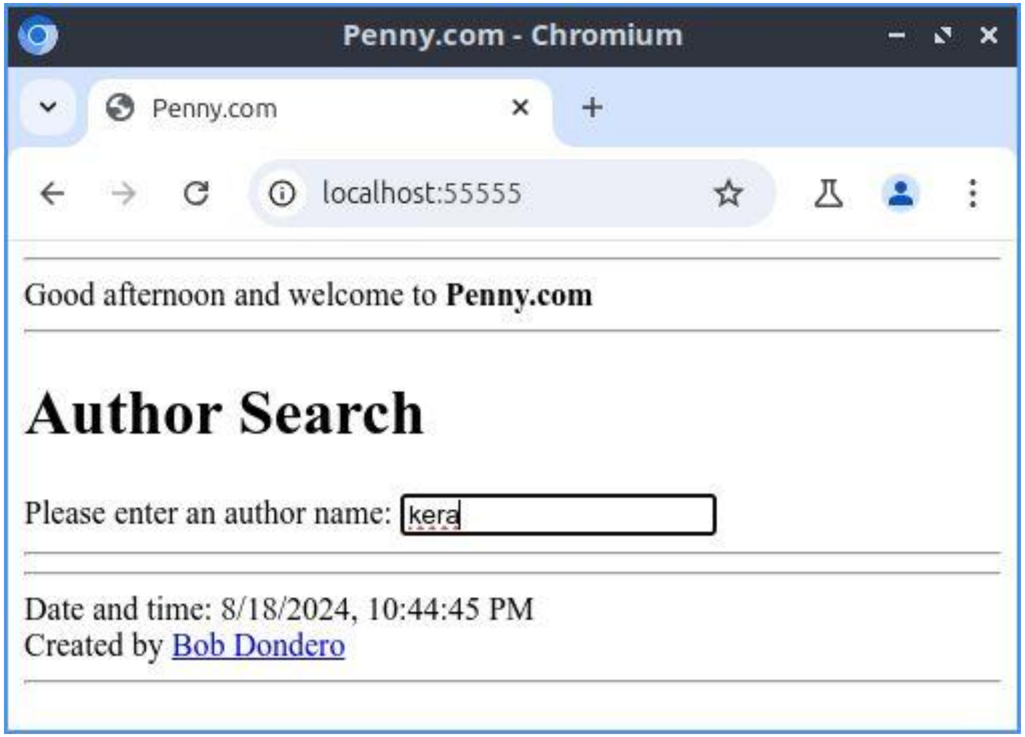
Review

- Recall **PennyAjax2** app (cont.)



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Review

- Recall **PennyAjax2** app (cont.)
  - runserver.py
  - penny.sql, penny.sqlite
  - database.py
  - **penny.py**
  - **index.html**

Agenda

- Review
- **AJAX enhancement 2**
- AJAX enhancement 3
- AJAX wrap-up
- JavaScript libraries
- jQuery

AJAX Enhancement 2

- **Problem**:
  - Server could be overwhelmed with requests
- **Solution:**
  - ***Debounce*** the requests

AJAX Enhancement 2

- See **PennyAjax3** app
  - runserver.py
  - penny.sql, penny.sqlite
  - database.py
  - penny.py
  - **index.html**

Agenda

- Review
- AJAX enhancement 2
- **AJAX enhancement 3**
- AJAX wrap-up
- JavaScript libraries
- jQuery

AJAX Enhancement 3

- **Problem**:
  - Code to generate HTML doc is ugly, inefficient
- **Solution:**
  - Use a **template engine**

Aside: Template Engines

- Python
  - Mustache, CheetahTemplate, Django, Genshi, **Jinja2**, Kid, Topsite, …
- JavaScript
  - **Mustache**, Squirrelly, Handlebars, …
- Java
  - Mustache, FreeMarker, Hamlets, Tiles, Thymeleaf, WebMacro, WebObjects, Velocity, …

https://en.wikipedia.org/wiki/Web_template_system

AJAX Enhancement 3

- See **PennyAjax4** app
  - runserver.py
  - penny.sql, penny.sqlite
  - database.py
  - penny.py
  - **index.html**

AJAX Enhancement 3

- **How to fetch the Mustache library…**

- **Option 1**
  - Command browser to fetch Mustache library from the **cdn** website
- **Option 2**
  - Ahead of time copy the Mustache library to **your** website
  - Command browser to fetch Mustache library from **your** website

Aside: Mustache

- Template (informally)
  - HTML string with placeholders
  - Each placeholder is identified by a Mustache variable

```
Hello <strong>{{username}}</strong>
and welcome
```

Aside: Mustache

- To instantiate a template:

```
let map = {somevar: someval, …};
let html = Mustache.render(sometemplate, map);
```

  - For each placeholder identified by `somevar` in `sometemplate`, Mustache replaces the placeholder with `someval`
- Automatically sanitizes/escapes `someval`
- Returns the resulting string

Aside: Mustache

- Template can contain:
  - Variables

```
… {{author}} …
```

Aside: Mustache

- Template can contain:
  - Iteration constructs

```
{{#books}}
   <strong>{{author}}</strong>
   …
{{/books}}
```

```
{{#somearray}}
   <strong>{{.}}</strong>
{{/somearray}}
```

Note:

- Unusual implicit specification of iteration object
- If books is falsy, then block is not rendered

Aside: Mustache

- Template can contain:
  - Selection constructs

```
{{#books}}
    …
{{/books}}
{{^books}}
    …
{{/books}}
```

If books is truthy, then first block is rendered
If books is falsy, then the second block is rendered

Aside: Mustache

- Template can contain:
  - Includes of other templates

```
…
{{>header}}
…
…
{{>footer}}
…
```

Aside: Mustache

- There is more to Mustache
- For more information:
  - https://github.com/janl/mustache.js

Agenda

- Review
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- AJAX enhancement 3
- **AJAX wrap-up**
- JavaScript libraries
- jQuery

AJAX Wrap-Up

- Each PennyAjax*N* app is a ***single page app (SPA)***
- SPAs are common
- SPAs are implemented using AJAX

AJAX Wrap-Up

AJAX Implementation	Browser Built-In or Library?	Async Mechanism	COS 333 Coverage
XMLHttpRequest	Built-in	Callbacks	Last lecture
fetch & AbortController	Built-in	Promises	Last lecture appendix
Axios	Library	Promises	None
jQuery	Library	Callbacks (or promises)	This lecture

AJAX Wrap-Up

AJAX Implementation	**Firefox**	**Chrome**
XMLHttpRequest	12+ (2012)	31+ (2013)
fetch	39+ (2015)	42+ (2015)
AbortController	57+ (2017)	66+ (2018)
Axios	12+ (2012)	31+ (2013)
jQuery	12+ (2012)	31+ (2013)

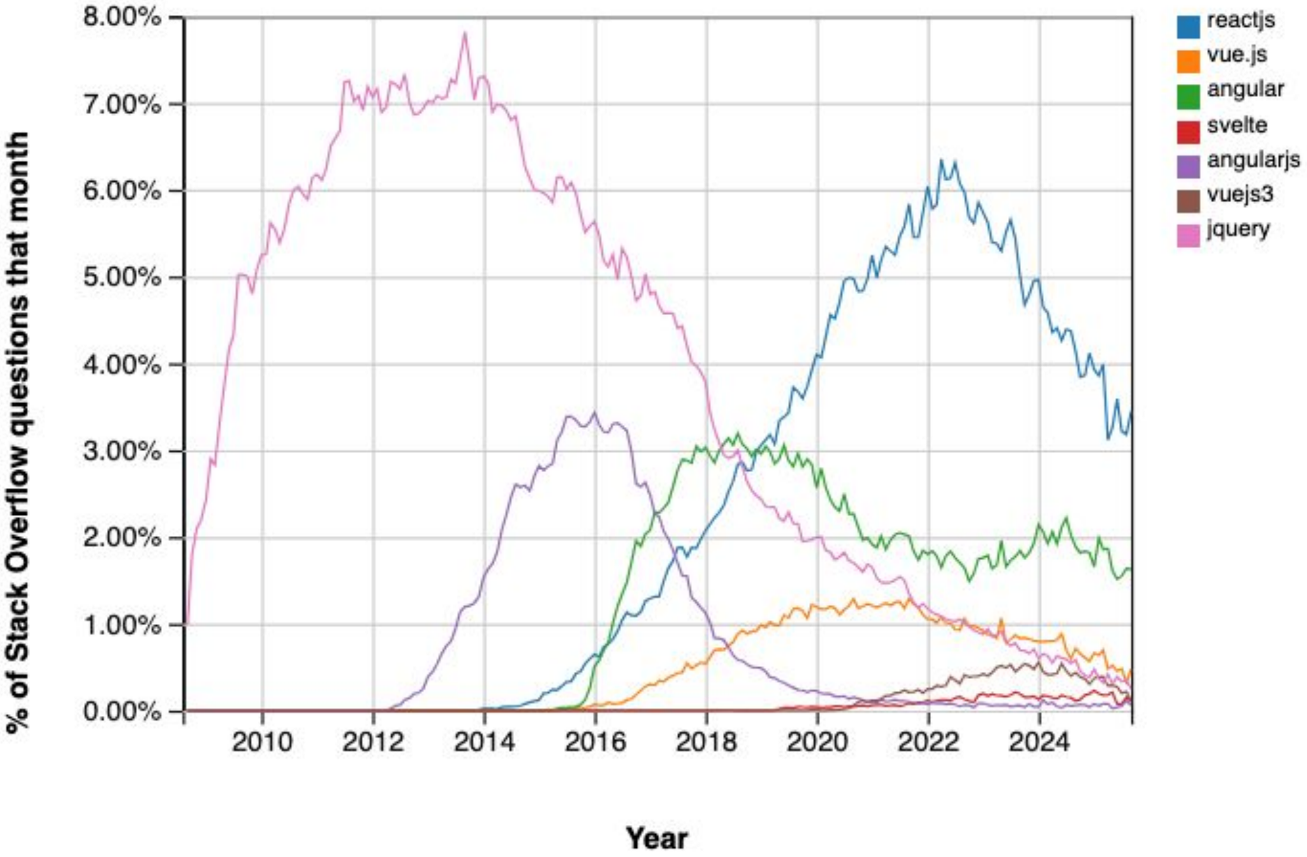
Agenda

- Review
- AJAX enhancement 2
- AJAX enhancement 3
- AJAX wrap-up
- **JavaScript libraries**
- jQuery

JavaScript Libraries

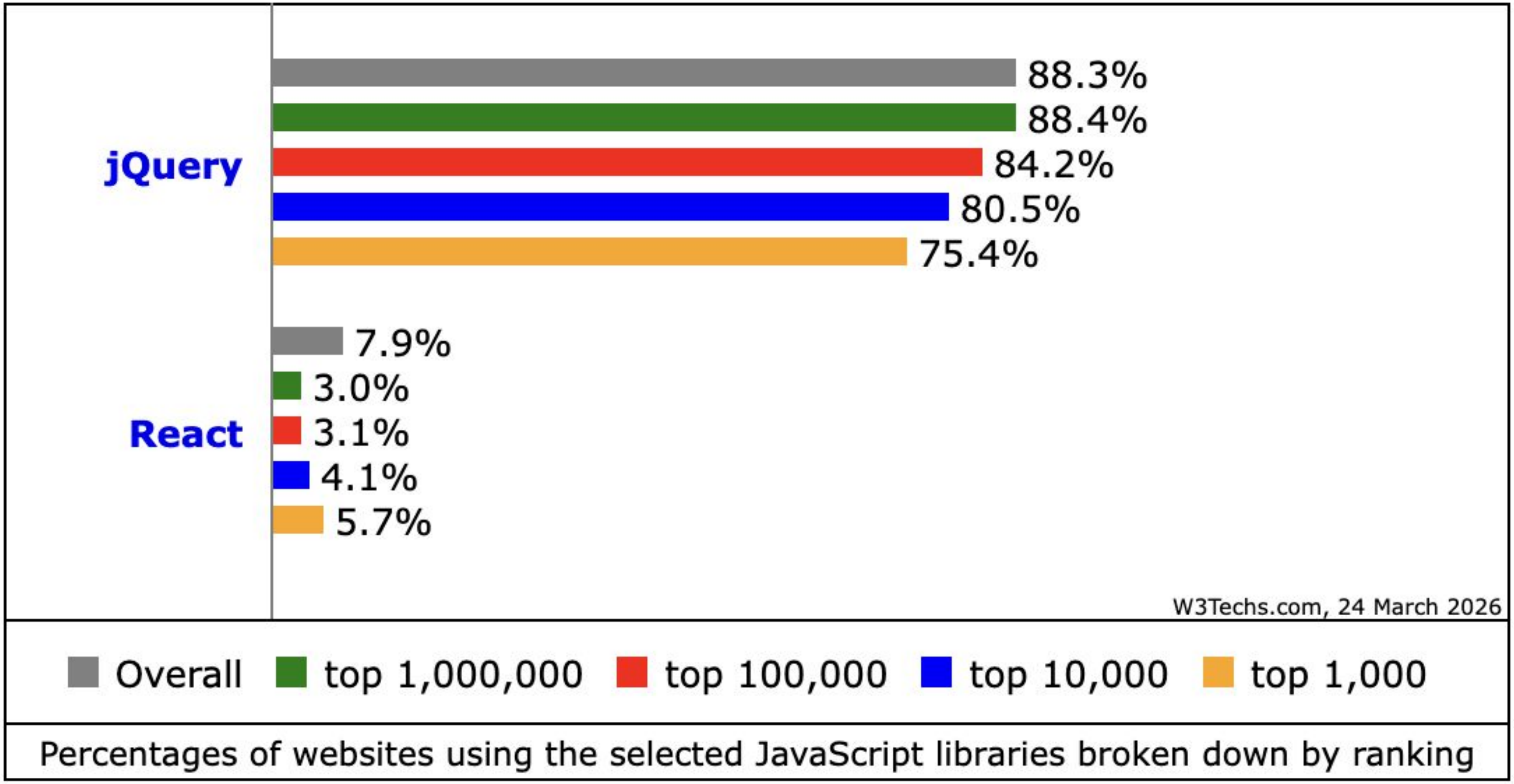
- **Problem**:
  - JavaScript/AJAX code uses common patterns and often is repetitive
- **Solution:**
  - Use a JavaScript **library**
    - **jQuery**, **React**, AngularJS, Angular, vue.js, vuejs3, svelte, …

JavaScript Libraries



As of Oct 2025, according to
https://insights.stackoverflow.com/trends?tags=reactjs%2Cvue.js%2Cangular%2Csvelte%2Cangularjs%2Cvuejs3%2Cjquery

JavaScript Libraries



As of March 2026, according to
https://w3techs.com/technologies/comparison/js-jquery,js-react

Agenda

- Review
- AJAX enhancement 2
- AJAX enhancement 3
- AJAX wrap-up
- JavaScript libraries
- **jQuery**

jQuery

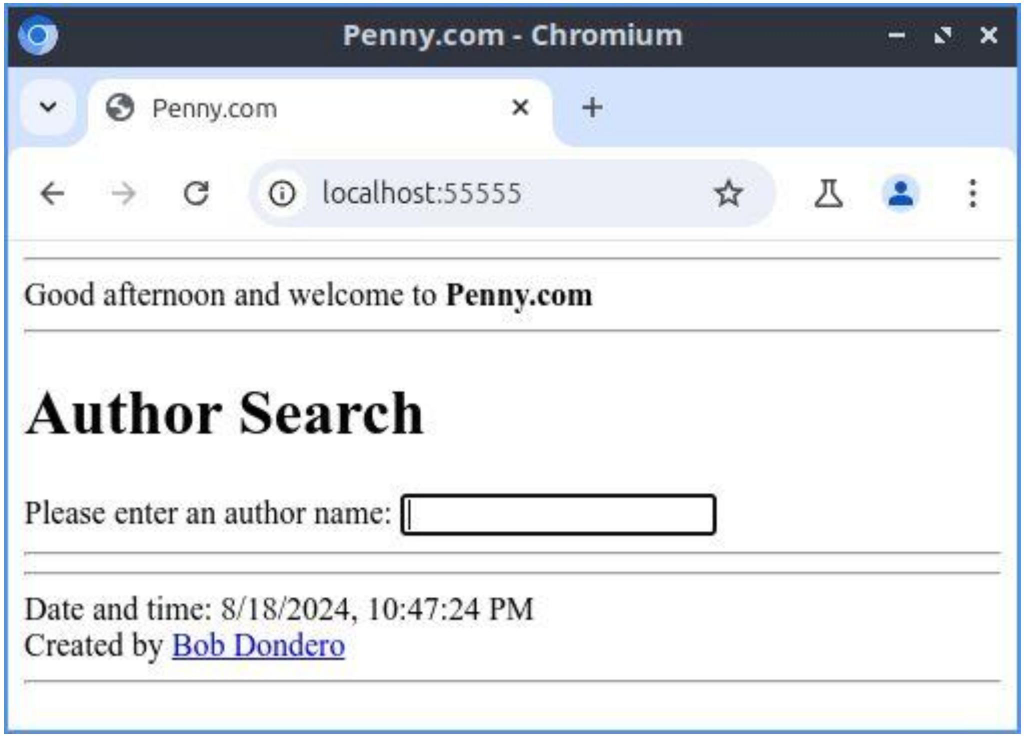
John
Resig

jQuery

- jQuery statement syntax:
  - **`jQuery(`*`selector`*`).`*`action`*`()`**
  - **`$(`*`selector`*`).`*`action`*`()`**
    - **`$`**
      - The jQuery function
    - ***`selector`***
      - Selects DOM node(s)
      - As in CSS; covered soon
    - ***`action`*`()`**
      - Specifies an action to be performed on the selected DOM node(s)

jQuery

- See **PennyJQuery** app



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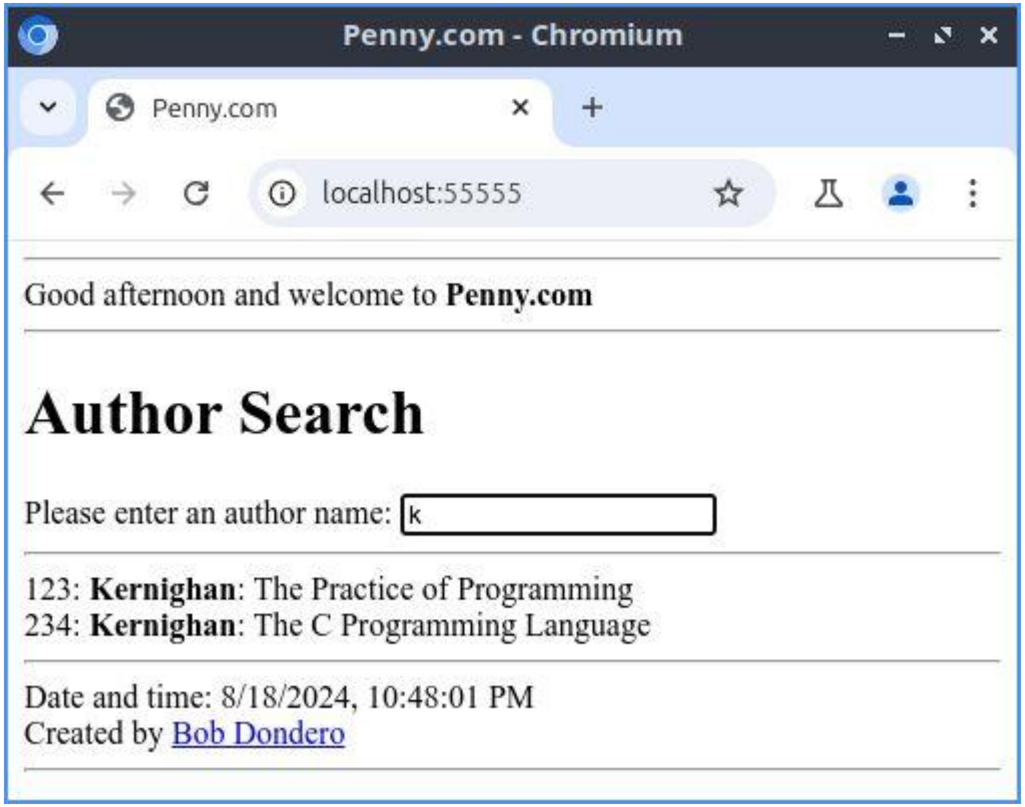
jQuery

- See **PennyJQuery** app



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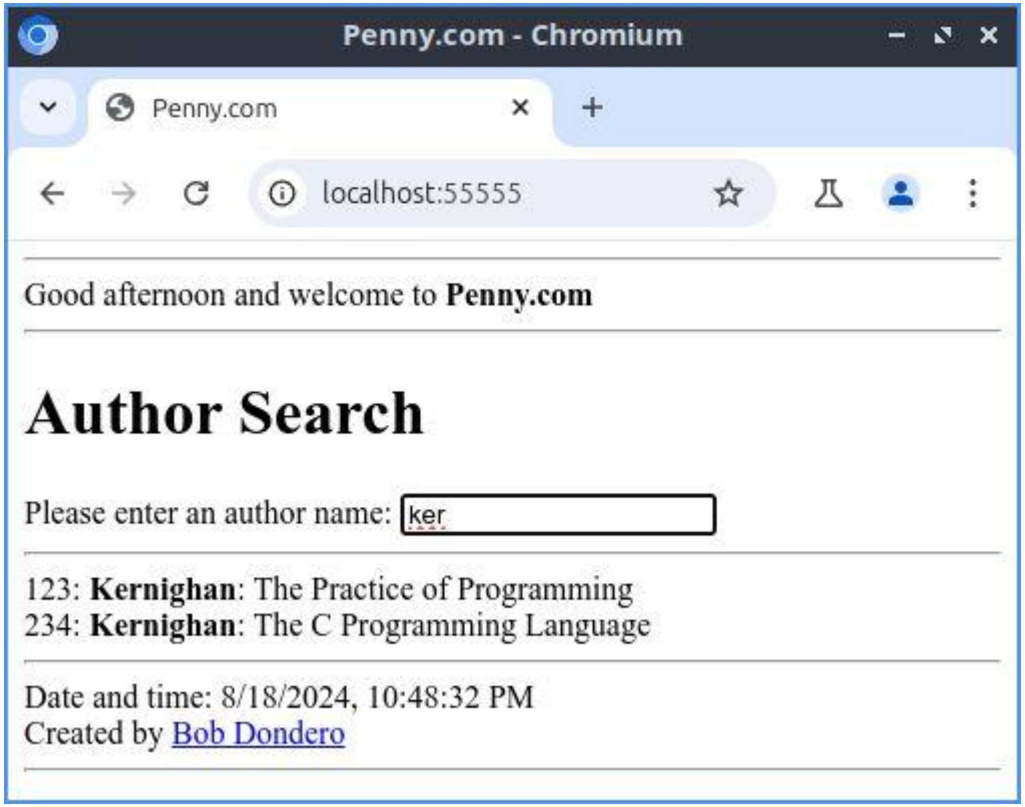
jQuery

- See **PennyJQuery** app



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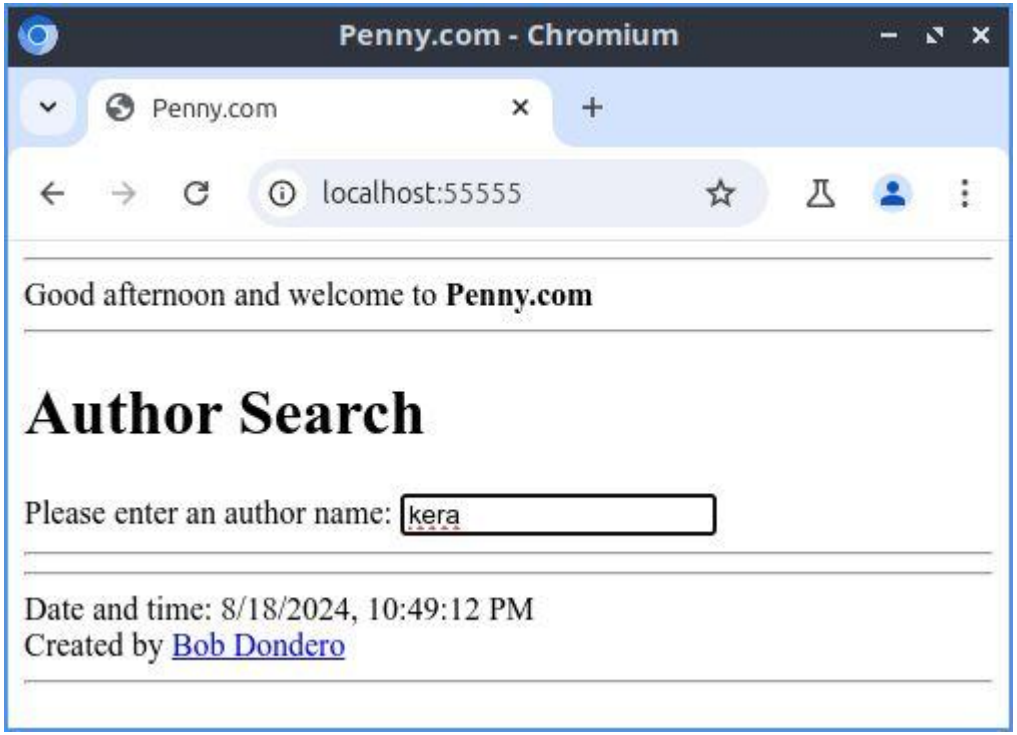
jQuery

- See **PennyJQuery** app



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jQuery

- See **PennyJQuery** app (cont.)
  - runserver.py
  - penny.sql, penny.sqlite
  - database.py
  - penny.py
  - **index.html**

jQuery

- jQuery makes accessing the DOM easier

Without jQuery:

```
let authorInput =
    document.getElementById('authorInput');
let author = authorInput.value;
```

With jQuery:

```
let author = $('#authorInput').val();
```

# => access by id

jQuery

- jQuery makes updating the DOM easier

Without jQuery:

```
let ampmSpan =
   document.getElementById('ampmSpan');
ampmSpan.innerHtml = amPm;
```

With jQuery:

```
$('#ampmSpan').html(amPm);
```

# => access by id

jQuery

- jQuery makes installing event handlers easier

Without jQuery:

```
let authorInput =
   document.getElementById('authorInput');
authorInput.addEventListener('input',
   debouncedGetResults);
```

With jQuery:

```
$('#authorInput').on('input',
    debouncedGetResults);
```

# => access by id

jQuery

- jQuery makes setup easier

Without jQuery:

```
document.addEventListener('DOMContentLoaded', setup);
```

With jQuery:

```
$('document').ready(setup);
```

# => access by id

jQuery

- jQuery makes AJAX easier

Without jQuery:

```
function handleResponse() {
   if (this.status !== 200) {
      alert('Error: Failed to fetch data from server');
         return;
   }
   let books = JSON.parse(this.response);
   let html = convertToHtml(books);
   let resultsDiv = document.getElementById('resultsDiv');
   resultsDiv.innerHTML = html;
}
function getResults() {
   ...
   request = new XMLHttpRequest();
   request.onload = handleResponse;
   request.onerror = handleError;
   request.open('GET', url);
   request.send();
}
```

jQuery

- jQuery makes AJAX easier (cont.)

With jQuery:

```
function handleResponse(books) {
   let html = convertToHtml(books);
   $('#resultsDiv').html(html);
}

function getResults() {   ...
   let requestData = {
      type: 'GET',
      url: url,
      success: handleResponse,
      error: handleError
   };
   request = $.ajax(requestData);
}
```

jQuery
parses JSON
automatically

jQuery

- jQuery pros
  - Easy to learn
    - Especially if you know CSS
    - Lots of web info
  - Easy to use
  - **Handles a wide variety of browsers**

jQuery

- jQuery cons
  - Less necessary with current browsers
  - Incompatible with client-side libraries that use a **virtual DOM** (e.g., React)

Lecture Summary

- In this lecture we covered:
  - The JavaScript Mustache template engine
  - JavaScript libraries for client-side web programming
  - jQuery