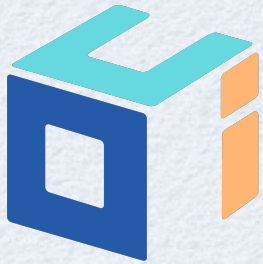
Svelte

slides at https://github.com/mvolkmann/talks

R. Mark Volkmann
Object Computing, Inc.
http://objectcomputing.com
Email: mark@objectcomputing.com
Twitter: @mark_volkmann
GitHub: mvolkmann



What Is It?

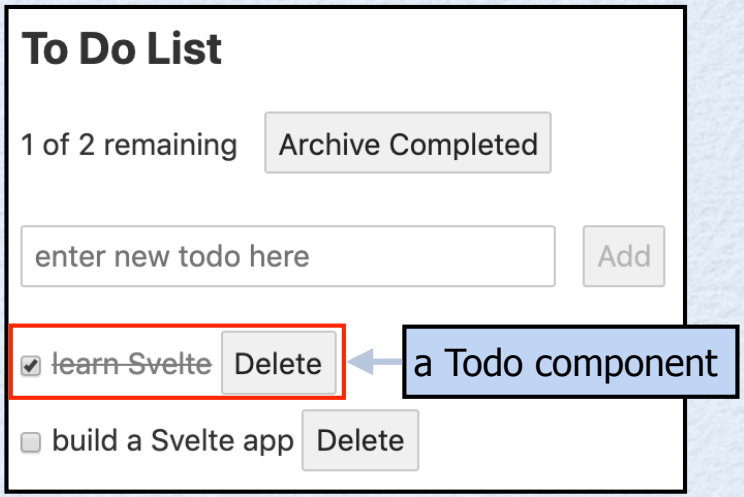
- Alternative to web frameworks like React, Vue, and Angular
- A web application **complier**, not a runtime library
  - implemented in TypeScript
  - compiles `.svelte` files to a single JavaScript file
  - no Svelte runtime `dependencies`, only `devDependencies`
- Doesn't use a virtual DOM
- Developed by **Rich Harris**
  - formerly at "The Guardian"; currently at "The New York Times"
  - previously created **Ractive** web framework - https://ractive.js.org/
    - used at "The Guardian"
    - inspired parts of Vue
  - created **Rollup** module bundler - https://rollupjs.org/
    - alternative to Webpack and Parcel

An Example

- Since you are all experienced web developers,
  let's look at an example app
  so you can compare the look of the code
  to your current favorite web framework
- On to the classic ... todo app!

Todo App ...

code and tests at
https://github.com/mvolkmann/svelte-todo



src/main.js

```
import TodoList from './TodoList.svelte';

const app = new TodoList({target: document.body});

export default app;
```

... Todo App ...

src/Todo.svelte

```
<script>
  import {createEventDispatcher} from 'svelte';
  import {fade} from 'svelte/transition';
  const dispatch = createEventDispatcher();
  export let todo; // the only prop
</script>

<style>
  .done-true {
    color: gray;
    text-decoration: line-through;
  }
  li {
    margin-top: 5px;
  }
</style>

<li transition:fade>
  <input
    type="checkbox"
    checked={todo.done}
    on:change={() => dispatch('toggleDone')}
  />
  <span class={'done-' + todo.done}>{todo.text}</span>
  <button on:click={() => dispatch('delete')}>Delete</button>
</li>
```

`script` and `style` sections are optional

`export` makes it a prop

What is the name of this component?
Can't tell.
Names are assigned when other components import this one.

interpolation

... Todo App ...

src/TodoList.svelte

```
<script>
  import Todo from './Todo.svelte';

  let lastId = 0;
  const createTodo = (text, done = false) => ({id: ++lastId, text, done});

  let todoText = '';
  let todos = [
    createTodo('learn Svelte', true),
    createTodo('build a Svelte app')
  ];

  $: uncompletedCount = todos.filter(t => !t.done).length;
  $: status = `${uncompletedCount} of ${todos.length} remaining`;

  function addTodo() {
    todos = todos.concat(createTodo(todoText));
    todoText = '';
  }

  const archiveCompleted = () => todos = todos.filter(t => !t.done);

  const deleteTodo = todoId => todos = todos.filter(t => t.id !== todoId);

  function toggleDone(todo) {
    const {id} = todo;
    todos = todos.map(t => t.id === id ? {...t, done: !t.done} : t);
  }
</script>
```

Top-level variables ARE the component state!

reactive declarations

No methods, just functions.

Not really archiving in this simple implementation, just deleting.

No `this` anywhere, just plain functions!

... Todo App ...

src/TodoList.svelte

```
<style>
  button {
    margin-left: 10px;
  }

  /* This removes bullets from a bulleted list. */
  ul.unstyled {
    list-style: none;
    margin-left: 0;
    padding-left: 0;
  }
</style>
```

... Todo App

src/TodoList.svelte

```
<div>
  <h2>To Do List</h2>
  <div>
    {status}
    <button on:click={archiveCompleted}>Archive Completed</button>
  </div>
  <form on:submit|preventDefault>
    <input
      type="text"
      size="30"
      autofocus
      placeholder="enter new todo here"
      bind:value={todoText}
    />
    <button disabled={!todoText} on:click={addTodo}>
      Add
    </button>
  </form>
  <ul class="unstyled">
    {#each todos as todo}
      <Todo
        todo={todo}
        on:delete={() => deleteTodo(todo.id)}
        on:toggleDone={() => toggleDone(todo)}
      />
    {/each}
  </ul>
</div>
```

not doing anything on submit

binds value of form element to a variable;
gives two-way data binding;
provides current value and
event handling for updating variable
when user changes value

Mustache-style markup

passing a prop; can be any JavaScript expression

Logic in Markup

- Three approaches for conditional and iteration logic
- **React**
  - uses JSX where logic is implemented by JavaScript code in curly braces
- **Angular** and **Vue**
  - support framework-specific attributes for logic
  - ex. `ngIf`, `ngFor`, `v-if`, `v-for`, …
- **Svelte**
  - supports mustache-like custom syntax that wraps elements
  - ex. `{#if}` and `{#each}`
  - can wrap multiple elements without introducing a new, common parent

Why does it make sense to specify conditional and iteration logic INSIDE elements using attributes?

Imagine if you could do that with JavaScript functions.

```
doSomething(
  arg1,
  arg2,
  if (arg1 > 10),
  for (arg1 in someCollection));
```

Isn't that weird?

Markup `if` Statement

- Begin with **`{#if condition}`**
  - starting with **`#`** indicates a block opening tag
- Can use **`{:else if condition}`** and **`{:else}`**
  - starting with **`:`** indicates a block continuation tag
- End with **`{/if}`**
  - starting with **`/`** indicates a block ending tag
- Include markup to be conditionally rendered
- Example

```
{#if color === 'yellow'}
  <div>Nice color!</div>
{:else if color === 'orange'}
  <div>That's okay too.</div>
{:else}
  <div>Questionable choice.</div>
{/if}
```

Markup `each` Statement

- Begin with **`{#each iterable as element}`**
  - include markup to be rendered for each element
- Optional **`{:else}`**
  - renders when iterable is empty
- End with **`{/each}`**
- Examples

```
{#each colors as color}
  <div style='color: {color}'>{color}</div>
{/each}
```

```
red
green
blue
```

```
{#each colors as color, index}
  <div>{index + 1}) {color}</div>
{/each}
```

```
1) red
2) green
3) blue
```

```
{#each people as {name, age}}
  <div>{name} is {age} years old.</div>
{:else}
  <div>There are no people.</div>
{/each}
```

can use destructuring when elements are objects

Promises in Markup

- Can wait for promises to resolve or reject in markup and render different markup for each and while pending

a bit like React Suspense

- Examples
  - assuming `getData` function returns a `Promise`

```
{#await getData()}
  <div>Waiting for data ...</div>
{:then result}
  <div>result = {result}</div>
{:catch error}
  <div class="error">Error: {error.message}</div>
{/await}
```

can use any name for variables after `:then` and `:catch`

```
{#await getData() then result}
  <div>result = {result}</div>
{:catch error}
  <div class="error">Error: {error.message}</div>
{/await}
```

can omit block to render while waiting for resolve or reject

can omit `catch` block

Top Svelte Features

- It's fast!
  - see https://krausest.github.io/js-framework-benchmark/current.html
  - can select frameworks to compare
- Small bundle sizes
- File-based component definitions
- CSS scoped by default
- Clear place to put global CSS
- Easy component state management (reactivity)
- Reactive statements (`$:`)
- Easy app state management (stores)
- Easy way to pass data from components to descendant components (context)
- Two-way data bindings
- Easy animations built-in
- Runtime warnings for accessibility issues

  ex. missing an `alt` attribute on an `img` element

Small Bundle Sizes

- Delivered code is much smaller,
  so loads faster in browsers
- Uses Rollup by default for module bundling,
  but can also use Webpack or Parcel
- Create production build with **`npm run build`**
- A RealWorld Comparison of Front-End Frameworks with Benchmarks
  - **`https://www.freecodecamp.org/news/a-realworld-comparison-of-front-end-frameworks-with-benchmarks-2019-update-4be0d3c78075/`**

Gzipped App Size in KBs

Angular+ngrx: 134
React+Redux: 193
Vue: 41.8
Svelte: 9.7

Lines of Code

Angular+ngrx: 4210
React+Redux: 2050
Vue: 2076
Svelte: 1116

Does It Disappear?

- Some say Svelte disappears once an app is built
- The Svelte library is mostly defined by **`.js`** files in **`node_modules/svelte`**
  - main functions are defined in **`internal.js`** which is currently ~1400 line of code
  - other library files used for specific features
    - **`easing.js`**, **`motion.js`**, **`register.js`**, **`store.js`**, **`transition.js`**
- **`npm run build`** produces files in **`public`** directory
  - including **`bundle.js`**
- Svelte library functions that are used by the app are copied to the top of **`bundle.js`**
  - in the case of the Todo app shown earlier, this is ~500 lines of code
- So Svelte doesn't disappear, it is just very small

File-based Component Defs

- **Angular** uses classes
- **React** uses functions or classes
- **Vue** uses object literals
- **Svelte** doesn't use any JavaScript container
  - JavaScript, CSS, and HTML in source files
    are combined to form the component definition
    which automatically becomes the default export
  - name is associated when imported and must start uppercase
    - can't tell from looking at source file what names might be used
  - lowercase names are reserved
    - for predefined elements like those in HTML and SVG

CSS

- Scoped by default
  - CSS specified in a component **`style`** tag
    is automatically scoped to the component
  - achieved by adding the same generated CSS class name, **`svelte-`*`hash`***,
    to each rendered element of the component affected by these CSS rules
  - CSS rules for component only apply to elements with this class name
- Clear place for global CSS
  - **`public/global.css`**
- svelte3 ESLint plugin warns about unused CSS selectors
  - see https://github.com/sveltejs/eslint-plugin-svelte3

Easy Component State Mgmt.

("reactivity")

- Changes to top-level variables referenced in interpolations automatically cause those interpolations to be reevaluated
- Example

```
<script>
  let count = 0;
  const increment = () => count++;
</script>

<div>count = {count}</div>
<button on:click={increment}>+</button>
```

- Must assign a new value to trigger
  - pushing new elements onto an array doesn't do this

```
myArr = myArr.concat(newValue);
```
works

```
myArr = [...myArr, newValue];
```
works

```
// Alternative trick
myArr.push(newValue);
myArr = myArr;
```
works

Reactive Statements

a.k.a. "destiny operator"

- `$:` is a "labeled statement" with label name "`$`" that Svelte treats as a "reactive statement"

Labeled statements can be used as targets of `break` and `continue` statements.
It is not an error in JavaScript to use same label more than once in same scope.

- Add as a prefix on top-level statements that should be repeated whenever any referenced variables change
- Examples

```
$: average = total / count;
$: console.log('count =', count);
```

like "computed properties" in Vue

great for debugging

When applied to an assignment to an undeclared variable it is called a "reactive declaration" and the `let` keyword is not allowed.

- Can apply to a block

```
$: {
  // statements to repeat go here
}
```

- Can apply to multiline statements like `if` statements

```
$: if (someCondition) {
  // body statements
}
```

re-evaluates condition if any variables it references change, and executes body only when true

Easy App State Mgmt.

- "Stores" hold application state outside any component
- Alternative to using props or context ← described later
  to make data available in components
- Where to define?
  - for stores that should be available to any component,
    define and export them in a file like `src/stores.js`
    and import them from that file wherever needed
  - for stores that should only be available to descendants of a given component,
    define them in that component and
    pass them to descendants using props or context

Kinds of Stores

- **Writable**
  - only kind that can be modified by components
  - methods
    - `set(newValue)`
    - `update(currentValue => newValue)` calculates new value from current value
- **Readable**
  - handle computing their data
  - components cannot modify
- **Derived**
  - derive data from current values of other stores

Defining Writable Stores

stores.js

```
import {writable} from 'svelte/store';

export const dogStore = writable([]);
```

initial value

using optional second argument

```
export const fancyStore = writable(
  initialValue,
  async set => {
    // Called when subscribe count goes from 0 to 1.
    // Compute initial value and pass to set function.
    const res = await fetch('/some/url');
    const data = await res.json();
    set(data);

    return () => {
      // Called when subscriber count goes to 0.
    }
  }
);
```

error handling omitted

Using Stores

- Option #1 - **subscribe** method - very verbose!
- Option #2 - **$** auto-subscription shorthand - much better!
  - variables whose names begin with **$** must be stores
  - automatically subscribes when first used
    and unsubscribes when removed from DOM

uses **subscribe** method

```
<script>
  import {onDestroy} from 'svelte';
  import {dogStore} from './stores.js';
  let dogs;
  const unsubscribe = dogStore.subscribe(value => dogs = value);
  onDestroy(unsubscribe);
</script>

<!-- Use dogs in HTML. -->
```

uses auto-subscription

```
<script>
  import {dogStore} from './stores.js';
</script>

<!-- Use $dogStore in HTML. -->
```

Easy Passing Data to Descendants

- Use "context"
- Alternative to props and stores for making data available in descendant components

```
import {getContext, setContext} from 'svelte';
```

- Ancestor components set context associated with the component

```
setContext(key, value);
```

  - must be called during component initialization

- Descendant components get context from closest ancestor that has context with given key

```
const value = getContext(key);
```

  - must be called during component initialization

More on Context

- Keys can be any kind of value, not just strings
- Values can be any kind of value
  including functions and objects with methods
- Context is not reactive!
  - descendant components are not re-rendered when context they use is changed in an ancestor component
  - use stores if reactivity is needed

Context Example

A.svelte

```
<script>
  import {setContext} from 'svelte';
  import B from './B.svelte';
  setContext('favorites', {color: 'yellow', number: 19});
</script>

<div>
  This is in A.
  <B />
</div>
```

Output

```
This is in A.
This is in B.
This is in C.
favorite color is yellow
favorite number is 19
```

B.svelte

```
<script>
  import C from './C.svelte';
</script>

<div>
  This is in B.
  <C />
</div>
```

C.svelte

```
<script>
  import {getContext} from 'svelte';
  const {color, number} = getContext('favorites');
</script>

<div>
  This is in C.
  <div>favorite color is {color}</div>
  <div>favorite number is {number}</div>
</div>
```

Two-way Data Bindings

- Form elements can be bound to a variable
- Simulates two-way data binding
- Provides current value and
  event handling for updating variable
  when user changes value

Binding Example ...


```
<script>
  const colors = ['red', 'orange', 'yellow', 'green', 'blue', 'purple'];
  const flavors = ['vanilla', 'chocolate', 'strawberry'];
  const seasons = ['Spring', 'Summer', 'Fall', 'Winter']
  let favoriteColor = '';
  let favoriteFlavors = [];
  let favoriteSeason = '';
  let happy = true;
  let name = '';
  let story = '';
</script>
```

these variables are bound to form elements on next two slides

... Binding Example ...

```
<div class="form">
  <div>
    <label>Name</label>
    <input type="text" bind:value={name} />
  </div>
  <div>
    <label>Happy?</label>
    <input type="checkbox" bind:checked={happy} />
  </div>
  <div>
    <label>Favorite Flavors</label>
    {#each flavors as flavor}
      <label>
        <input type="checkbox" value={flavor} bind:group={favoriteFlavors} />
        {flavor}
      </label>
    {/each}
  </div>
```

for checkboxes, bind to **checked** property rather than **value**

using **bind:group** with a set of related checkboxes makes the value an array of strings

... Binding Example

```
<div>
  <label>Favorite Season</label>
  {#each seasons as season}
    <label>
      <input type="radio" value={season} bind:group={favoriteSeason} />
      {season}
    </label>
  {/each}
</div>
<div>
  <label>Favorite Color</label>
  <select bind:value={favoriteColor}>
    <option />
    {#each colors as color}
      <option>{color}</option>
    {/each}
  </select>
</div>
<div>
  <label>Life Story</label>
  <textarea bind:value={story} />
</div>
```

using **bind:group** with a set of related radio buttons makes the value a single string

to change a select to a scrollable list that allows selecting multiple options add **multiple** attribute; makes the value an array of selected values

Easy Animations Built-in

- **`svelte/animate`** provides
  - `flip`
- **`svelte/motion`** provides
  - `spring`
  - `tweened`
- **`svelte/transition`** provides
  - `crossfade`
  - **`draw`** - for SVG elements
  - **`fade`**
  - **`fly`** - set **`x`** and/or **`y`**
  - **`scale`**
  - **`slide`**
- Also see **`svelte/easing`**

basic example

```
<script>
  import {fade} from 'svelte/transition';
  ...
</script>

<li transition:fade>
  <!-- some content -->
</li>
```

this fades in when mounted and fades out when destroyed

Outstanding Issues

- TypeScript support
  - it's coming, but not ready yet
  - https://github.com/sveltejs/svelte/issues/1639
- Popularity
  - perhaps Svelte will soon be considered the #4 most popular approach for building web apps
  - isn't easy to find developers that already know it
  - but it's very easy to learn and there is less to learn than other approaches

Creating a Project

- Install Node.js from https://nodejs.org
  - installs **`node`**, **`npm`**, and **`npx`** commands
- Approach #1
  - **`npx degit sveltejs/template`** ***`app-name`***
  - **degit** is useful for project scaffolding
- Approach #2
  - browse https://svelte.dev/repl
  - click download button
  - unzip downloaded zip file
  - demo this!

`degit` was created by Rich Harris.
It downloads a git repo,
by default the master branch.
In this case **`sveltejs`** is the user name
and **`template`** is the repo.
The second argument is the
name of the directory to create.

Installing and Running

- **`cd` *`app-name`***
- **`npm install`**
- **`npm run dev`**
  - provides live reload, unlike **`npm run start`**
  - syntax errors are reported in window where this is running, not in browser because it doesn't produce a new version of the app if there are errors
- Browse **`localhost:5000`**
- Just renders "Hello world!"

Topics Not Covered Here

but covered at https://objectcomputing.com/resources/publications/sett/july-2019-web-dev-simplified-with-svelte

- Inserting HTML
- Slots
  - for passing child elements to a component
- Event details
  - handling, modifiers, dispatching
- Lifecycle functions
  - `onMount`, `beforeUpdate`, `afterUpdate`, and `onDestroy`
- Actions
  - register a function to be called when a specific element is added to DOM
  - ex. moving focus
- Routing
  - can use `page` on npm or Sapper
- Module Context
  - to run JavaScript code in a component source file only once instead of once for each component instance created
- Special Elements
  - `<svelte:name ...>`
- Debugging with `{@debug}`
  - debugger breaks on state changes
- Unit tests
  - with Jest and Svelte Testing Library
- End-to-end tests
  - with Cypress
- Compiling to custom elements
  - can be used with any framework

Related Tools

- **"Svelte" VS Code extension**
  - provides syntax highlighting and intellisense
- **Sapper** - https://sapper.svelte.dev/
  - "application framework powered by Svelte"
  - similar to Next and Gatsby
  - provides routing, server-side rendering, and code splitting
- **Svelte Native** - https://svelte-native.technology/
  - for implementing native mobile apps
  - based on NativeScript
  - community-driven project
- **Svelte Testing Library** - https://testing-library.com/docs/svelte-testing-library/intro
- **Storybook** with Svelte - https://storybook.js.org/docs/guides/guide-svelte/

Svelte Resources

- **"Rethinking Reactivity" talk by Rich Harris**
  - delivered multiple times, most recently at "Shift Conference" June 20, 2019
  - explains motivation for Svelte and compares to React
- **Home page** - https://svelte.dev
  - contains **Tutorial**, **API Docs**, **Examples**, online **REPL**, **Blog**, and **Sapper** link
    - REPL is great for trying small amounts of Svelte code
    - REPL can save for sharing and submitting issues
- **Discord chat room** - https://discordapp.com/invite/yy75DKs
- **GitHub** - https://github.com/sveltejs/svelte
- **Awesome Svelte** - https://github.com/CalvinWalzel/awesome-svelte
- **Awesome Svelte Resources** - https://github.com/ryanatkn/awesome-svelte-resources

Conclusion

- Svelte is a worthy alternative to the current popular options of React, Vue, and Angular
- For more, see my long article
  - https://objectcomputing.com/resources/publications/sett/july-2019-web-dev-simplified-with-svelte