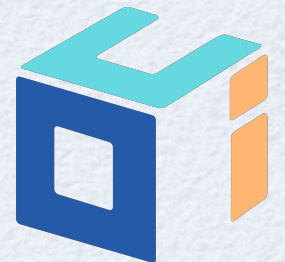




# Svelte

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

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OCI | TRAINING



# Svelte Overview ...

- A web application compiler, not a runtime library
  - compiles `.svelte` files to `.js` files
  - no Svelte runtime dependencies
- Alternative to web frameworks like React, Vue, and Angular
- Developed by Rich Harris
  - formerly at The Guardian; current at The New York Times
  - previously created the Ractive web framework - <https://ractive.js.org/>
    - used at The Guardian
    - inspired parts of Vue
  - created Rollup module bundler - <https://rollupjs.org/>
- Can build entire app or  
add components to existing apps implemented with other frameworks



# ... Svelte Overview

- Supports reactivity, not a virtual DOM
- Much faster
  - significantly faster than apps built with other frameworks; check the benchmarks!
  - mostly because it doesn't need to build a virtual DOM and perform DOM diffing
  - more suitable for running on low-powered devices
- Delivered code is much smaller
  - uses Rollup by default for module bundling, but can also use Parcel or Webpack
  - create production build with `npm run build`
- Provides live reload
- Provides runtime warnings for accessibility issues
  - ex. missing an `alt` attribute on an `img` element



# Svelte Resources

- “Rethinking reactivity” - <https://www.youtube.com/watch?v=AdNJ3fydeao>
  - talk by Rich Harris at “You Gotta Love Frontend (YGLF) Code Camp 2019”
- Home page - <https://svelte.dev/>
- Tutorial - <https://svelte.dev/tutorial/>
- Online REPL - <https://svelte.dev/repl/>
- Discord chat room - <https://discordapp.com/invite/yy75DKs>



# Getting Started

- **`npx degit sveltejs/template app-name`**
  - **deg**it is an npm package that copies a git repository
  - useful for project scaffolding
- **`cd app-name`**
- **`npm install`**
- **`npm run dev`** NOT `npm run start`!
  - provides live reload
  - syntax errors are reported in window where this is running, not in browser because it doesn't produce a new version of the app
- browse **`localhost:5000`**
- Just outputs "Hello world!" in purple

# Generated `index.html`

- In `public/index.html`

```
<!doctype html>
<html>
<head>
  <meta charset='utf8'>
  <meta name='viewport' content='width=device-width'>

  <title>Svelte app</title>

  <link rel='icon' type='image/png' href='favicon.png'>
  <link rel='stylesheet' href='global.css'>
  <link rel='stylesheet' href='bundle.css'>
</head>

<body>
  <script src='bundle.js'></script>
</body>
</html>
```

the Svelte logo

non-scoped CSS

scoped CSS from `.svelte` files

bundled JavaScript code



# Generated Source Files

uses tabs for indentation by default

- In `src/main.js`

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

const app = new App({
  target: document.body,
  props: {
    name: 'world'
  }
});

export default app;
```

- In `src/App.svelte`

```
<script>
  export let name;
</script>

<style>
  h1 {
    color: purple;
  }
</style>

<h1>Hello {name}!</h1>
```

exported variables  
can be set as props

Curly braces (interpolation)  
are used to output the value  
of a JavaScript expression.  
They are also used for  
dynamic attribute values.

# Svelte Components

- Implemented in `.svelte` files under `src` directory
- Can have three sections

```
<script>  
  // JavaScript goes here.  
</script>  
  
<style>  
  /* Scoped CSS rules go here. */  
</style>  
  
<!-- HTML goes here. -->
```

Note the different styles of comments that can be used in each section.



# Props ...

- Components can accept input through props
- Specified as attributes on a component element in parent components
- Declared in `<script>` section of component with **export** keyword
- Example
  - in parent component

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

```
<Hello name="Mark" />
```

prop values that are expression or non-string literals are surrounded by curly braces instead of quotes

- in child component defined in `Hello.svelte`

```
<script>  
  export let name;  
</script>
```

```
<div>  
  Hello, {name}!  
</div>
```

must be `let`, not `const`;  
can assign a default value

# ... Props

- Can use object spread to pass multiple props
- Example

```
<script>  
  import Hello from './Hello.svelte';  
  let helloProps = {name: 'Mark', color: 'yellow'};  
</script>  
  
<Hello {...helloProps} />
```

- Is there any way to validate props?



# Styling

- Styles in `<style>` tags of `.svelte` files are automatically scoped to the component
  - adds same CSS class named `svelte-hash` to all rendered tags
- Global styles go in `public/global.css`
- Can use `/* */` comments, but not `//`
- Provides animation effects typically used for transitions
  - and makes it easy to implement custom animations
- “svelte3” ESLint plugin warns about unused CSS selectors
- Can conditionally add a CSS class to an element
  - example `<div class:error="{status > 0}">{result}</div>`
  - Why are the quotes required?

# Attributes

- To supply an attribute value from a JavaScript expression
  - `<tag attr={expression}>`
- Shorthand syntax if value is in a variable with same name as attribute
  - `<tag foo={foo}>` is the same as `<tag {foo}>`



# Importing Components

- A component can import others inside its script tag
  - ex. `import Other from './Other.svelte';`
- Imported components can then be used in the HTML section

# Inserting HTML

- To render a JavaScript expression whose value is an HTML string
  - `{@html expression}`
- Example
  - suppose `markup` is a variable that holds a string of HTML
  - `<p>{@html markup}</p>`
- Cross-site Scripting
  - you must escape HTML from untrusted sources to avoid this



# Event Handling

- Specify with `on:event-name` attribute set to a function

- Examples

```
<button on:click={handleClick}>Press Me</button>
```

reference to function define in `script` section

```
<button on:click={event => clicked = event.target}>Press Me</button>
```

inline event handling

- Event object is passed to event handling function
- Can specify an number of event modifiers

- with vertical bars following by modifier names

- ex. 

```
<button on:click|once|preventDefault={handleClick}>Press Me</button>
```

- modifiers are

- `capture` - invokes handler only in capture phase instead of default bubbling phase
    - `once` - removes handler after first occurrence
    - `passive` - can improve scrolling performance
    - `preventDefault` - prevents the default action
    - `stopPropagation` - prevents subsequent handlers in the capture/bubbling flow from being invoked

# Dispatching Events

- Components can dispatch events

```
<script>
  import {createEventDispatcher} from 'svelte';
  const dispatch = createEventDispatcher();
  function sendEvent() {
    dispatch('event-name', optionalData);
  }
</script>
```

must be called when component is instantiated

data can be a primitive or an object

- These events only go to the parent component

- they do not automatically bubble further up
- parent listens for events on child instance

```
<Child on:event-name={handleEvent} />
```

handleEvent is a parent component function

- Shorthand to forward events up

- if component hierarchy is **A** > **B** > **C** and **C** emits event "foo", **B** can forward it up to **A** with
- also works with DOM events to forward from child component to parent

```
<C on:foo />
```



# Binding Form Elements ...

- Form elements can be bound to a variable
  - provides current value and event handling for updating the variable when user changes value
- Automatically coerces **input** values from strings to numbers when type is **number** or **range**
- Example

Name

Happy? ☒

Favorite Flavors ☒ vanilla ☐ chocolate ☒ strawberry

Favorite Season ☒ Spring ☐ Summer ☐ Fall ☐ Winter

Favorite Color

Life Story

Mark likes yellow, Spring, and is happy.

Mark's favorite flavors are vanilla, strawberry.

Story: Once upon a time ...

# ... Binding Form Elements ...

```
<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>
```

```
<style>
  div {
    margin-bottom: 10px;
  }

  input,
  select {
    border: solid gray 1px;
    border-radius: 4px;
    padding: 4px;
  }

  input[type='checkbox'],
  input[type='radio'] {
    margin-left: 5px;
  }

  label {
    display: inline-block;
    font-weight: bold;
    margin-right: 5px;
    vertical-align: top;
  }
</style>
```



# ... Binding Form Elements ...

```
<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 Form Elements ...

```
<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 strings

add `multiple` attribute to a `select` to change it to a scrollable list that allows selecting multiple options

option elements can have a `value` attribute and its value can be a string, number, or object



# ... Binding Form Elements

```
{#if name}  
  <div>  
    {name} likes {favoriteColor}, {favoriteSeason},  
    and is {happy ? 'happy' : 'unhappy'}.  
  </div>  
  <div>{name}'s favorite flavors are {favoriteFlavors}.</div>  
  <div>Story: {story}</div>  
{/if}  
</div>
```

This part just reports the variable values set by the binds.

- When **#each** is used to iterate over objects in an array, form elements inside can bind to properties of those objects
  - user input then causes those objects to be mutated

# Binding Custom Props

- Can bind a child component prop to a variable in parent component
- Allows child component to change value of a parent component variable
- Example

```
Parent.svelte
<script>
  import Child from './Child.svelte';
  let pValue = 1;
</script>

<div>pValue = {pValue}</div>
<Child bind:cValue={pValue} />
```

```
Child.svelte
<script>
  export let cValue = '';
  const double = () => cValue *= 2;
</script>

<div>cValue = {cValue}</div>
<button on:click={double}>Double</button>
```

- when `child` button is pressed, `cValue` is doubled and that becomes the new value of `pValue` because it is bound to `cValue`



# Reactivity

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

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

<label>Count =</label>
<button on:click={increment}>+</button>
```

# Reactive Declarations

- `$:` is a “labelled statement” with label name “`$`” that Svelte treats as a “reactive declaration”

Why doesn't ESLint complain about duplicate labels?

- Add `$` as a prefix on statements that should be repeated whenever any referenced variables change

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

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

- Examples

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

← great for debugging

- Can apply to a block

```
$: {  
  // statements to be repeated here  
}
```

- Can apply to multiline statements like `if` statements

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

Does the body only execute again if a variable in the condition changes and the condition still evaluates to true?



# Markup `if` Statement

- Begin with `{#if condition}`
  - starting with `#` indicates a block opening tag
- End with `{/if}`
  - starting with `/` indicates a block ending tag
- Can use `{:else}`
  - starting with `:` indicates a block continuation tag
  - can include an `if`
- 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}`
  - starting with # indicates a block opening tag
- End with `{/each}`
  - starting with / indicates a block ending tag
- Include markup to be rendered for each element
- 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

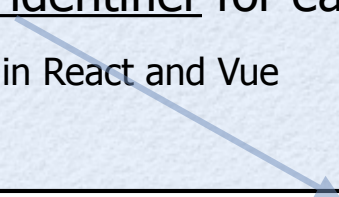
```
{#each people as {name, age}}  
  <div>{name} is {age} years old.</div>  
{/each}
```

can use destructuring  
when elements are objects



# ... Markup each Statement

- Need a unique identifier for each element if items will be removed
  - similar to a key in React and Vue
- Examples



```
{#each people as person (person.id)}  
  <div>{name} is {age} years old.</div>  
{/each}
```

# Promises in Markup

- Can wait for promises to resolve or reject in markup and render different elements for each
- Examples
  - `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}
```

```
{#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



# Slots

- Allow child elements to be passed to a component
- Component can decide whether and where to render them
- `<slot />` is a “default slot” that marks the spot where all children are unconditionally rendered
- `<slot>default content</slot>` is the same, but specifies content to render if there is no child content
  - note that whitespace counts as child content
- `<slot name="slotName">default content</slot>` is a named slot
  - can have any number of these in component
  - children specify target slot with `slot` attribute on any child element
    - example 

```
<div slot="address">
  123 Some Street<br>
  Some City, Some State 12345
</div>
```

# onMount ...

- Most commonly used lifecycle function
- Registers a function to be called when a component is mounted in DOM
- Some uses
  - move focus into a given form element
  - retrieve data from a REST service (recommended place to do this)

- Example

```
<script>
  import {onMount} from 'svelte';
  let name = '';
  let nameInput;
  onMount(() => nameInput.focus());
</script>

<input bind:this={nameInput} bind:value={name} />
```

- To run a function when component is destroyed, return it from **onMount**
  - similar to React **useEffect** hook



# ... onMount

- Can be called from helper functions
  - similar to defining custom React hooks
  - can share these between components
  - recommended to name these starting with `on`
    - React hook names that start with `use`

# Other Lifecycle Functions

- **beforeUpdate**
  - registers a function to be called immediately before component DOM updates
  - first run is before component is mounted, and no component DOM will be present yet
- **afterUpdate**
  - registers a function to be called immediately after component DOM updates
-



# Batched DOM Updates

- “When you invalidate component state in Svelte, by changing component variables it doesn't update the DOM immediately. Instead, it waits until the next microtask to see if there are any other changes that need to be applied, including in other components. Doing so avoids unnecessary work and allows the browser to batch things more effectively.”
- The **tick** function “returns a promise that resolves as soon as any pending state changes have been applied to the DOM (or immediately, if there are no pending state changes).”
- To make state changes after DOM updates have been applied

```
<script>
  import {tick} from 'svelte';
  ...
  // Make some state changes.
  await tick();
  // Make more state changes after DOM updates.
  ...
</script>
```

prevents batching of updates  
that occur after the call to **tick**



# Stores

- Holds application state outside any component
- Alternative to using props to share state between components
- Recommended to define and export all stores needed by an app in `src/stores.js`
- Three provided kinds of stores
  - **writable** stores - only kind that can be modified by components
  - **readable** stores
  - **derived** stores - derive their value from current values of other stores
  - all have **subscribe** method
- Can implement custom stores
  - any object with a properly implemented **subscribe** method
  - see example at <https://svelte.dev/tutorial/custom-stores>



# Writable Stores

- Call **writable** function to create
- Also have these methods
  - **set**(*newValue*)
  - **update**(*currentValue* => *newValue*) calculated from current value
- To create

```
stores.js
import {writable} from 'svelte/store';
export const dogStore = writable([]); pass initial value
```

- Can bind to a writable store
  - example `<input bind:value={$someStore}>`
  - user changes to the `input` update the store

# Readable Stores

- Call **readable** function to create
- Specify initial value
- Optionally provide function that takes **set** function
  - called when first subscriber subscribes
  - obtain value and pass to **set**
- Optionally return a function
  - called when last subscriber unsubscribes to perform cleanup
- Example

```
stores.js
import {readable} from 'svelte/store';

export const catStore = readable(
  [], // initial value
  set => {
    const res = await fetch('/cats');
    const cats = await res.json();
    set(cats);
    // Can return cleanup function here.
  }
);
```

can use **setInterval** to continuously change value



# Using Stores

- Import from where defined
- Two options to access
  - **subscribe** method
  - **\$** auto-subscription shorthand
    - requires store to be imported at top-level of component
    - all variables whose names begin with \$ must be stores

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

uses **subscribe** method

very verbose!

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

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

uses auto-subscription

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

# Context

- Alternative to props and stores for passing data from a component to a descendant

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

- Ancestor components set context

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

- Descendant components get context

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

- Keys can be any kind of value, not just strings
- Values can be any kind of value including objects with methods



# 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>
```

# Animation ...

- `svelte/animate` provides
  - `flip`
- `svelte/motion` provides
  - `spring`
  - `tweened`
- `svelte/transition` provides
  - `crossfade`
  - `draw`
  - `fade`
  - `fly`
  - `scale`
  - `slide`
- Also see `svelte/easing`



# ... Animation

- Can implement custom transitions
  - see example at <https://svelte.dev/tutorial/custom-css-transitions>
- Can listen for events to know when a transition is complete
  - `on:introstart`
  - `on:introend`
  - `on:outrostart`
  - `on:outbound`
- Also see local transitions and delayed transitions



# Special Elements ...

- **`<svelte:component this={componentRef}>`**
  - renders component specified by variable `componentRef`
  - renders nothing if `componentRef` is falsy
  - Can you pass props to the component?
- **`<svelte:self props>`**
  - allows a component to render an instance of itself
  - supports recursive components
  - needed because a component cannot import itself
- **`<svelte:window on:eventName={handler}>`**
  - listens for events on `window` object
- **`<svelte:window bind:propertyName={variable}>`**
  - binds a variable to a `window` property (ex. `innerWidth`)
- **`<svelte:body on:eventName={handler}>`**
  - listens for events on `body` object (ex. `mouseenter` and `mouseleave`)



# ... Special Elements

- **`<svelte:head>elements</svelte:head>`**
  - inserts elements in **head** of document (ex. **link** and **script** tags)
  - When is it useful for a component to do this?
  - Is it discouraged?
- **`<svelte:options option={value} />`**
  - specifies compiler options including:
  - **immutable** means props will be treated as immutable (an optimization)
  - **accessors** adds getter and setter methods for the component props
    - Why would parent components want to call these?
  - **namespace="value"** specifies namespace of component
    - Why needed?
  - **tag="value"** specifies name to use when compiled as a custom element
    - Why do this?



# Module Context

- To run JavaScript code in a component source file only once instead of once for each component instance created, include in

```
<script context="module">  
  ...  
</script>
```

- When a **script** tag doesn't specify a **context**, it is "instance context"
- Can specify both kinds of **script** tags in a component source file
  - can export values from both contexts
  - cannot have a default export because the component itself is automatically treated as the default export
- Can declare variables and define function in module context that are accessible in instance context of all component instances
  - allows sharing data between all instances



# Debugging

- To break when given variables change and output their values in devtools console

```
{@debug var1, var2, var3}
```

- Variables can refer to any kind of value including objects and arrays

# Related Tools

- **Svelte** VS Code extension
- **Sapper** - <https://sapper.svelte.dev/>
  - “application framework powered by Svelte”
  - name may be a traction of “Svelte” and “Application”
  - 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-vue
  - a community-driven project
- **Svelte GL** - <https://github.com/Rich-Harris/svelte-gl>
  - in-work Svelte version of Three.js



# ESLint Setup

- Create `.eslintrc.json` file
- `npm install -D name` where *name* is
  - `eslint`
  - `eslint-plugin-html`
  - `eslint-plugin-import`
  - `eslint-plugin-svelte3`

```
{
  "env": {
    "browser": true,
    "es6": true
  },
  "extends": [
    "eslint:recommended",
    "plugin:import/recommended"
  ],
  "parserOptions": {
    "ecmaVersion": 2019,
    "sourceType": "module"
  },
  "plugins": ["svelte3"],
  "rules": {
    "no-console": "off",
    "svelte3/lint-template": true
  }
}
```

- Add npm script

```
"lint": "eslint --fix --quiet src --ext .js,.svelte",
```

- Run with `npm run lint`
- For more info see <https://github.com/sveltejs/eslint-plugin-svelte3>

# Prettier Setup

- Create `.prettierrc` file

```
{  
  "bracketSpacing": false,  
  "singleQuote": true  
}
```

- `npm install -D name` where *name* is

- `prettier`
- `prettier-plugin-svelte`

- Add npm script

```
"format": "prettier --write '{public,src}/**/*.{css,html,js,svelte} '",
```

- Run with `npm run lint`
- Will enforce section order of `<script>`, `<style>`, and HTML