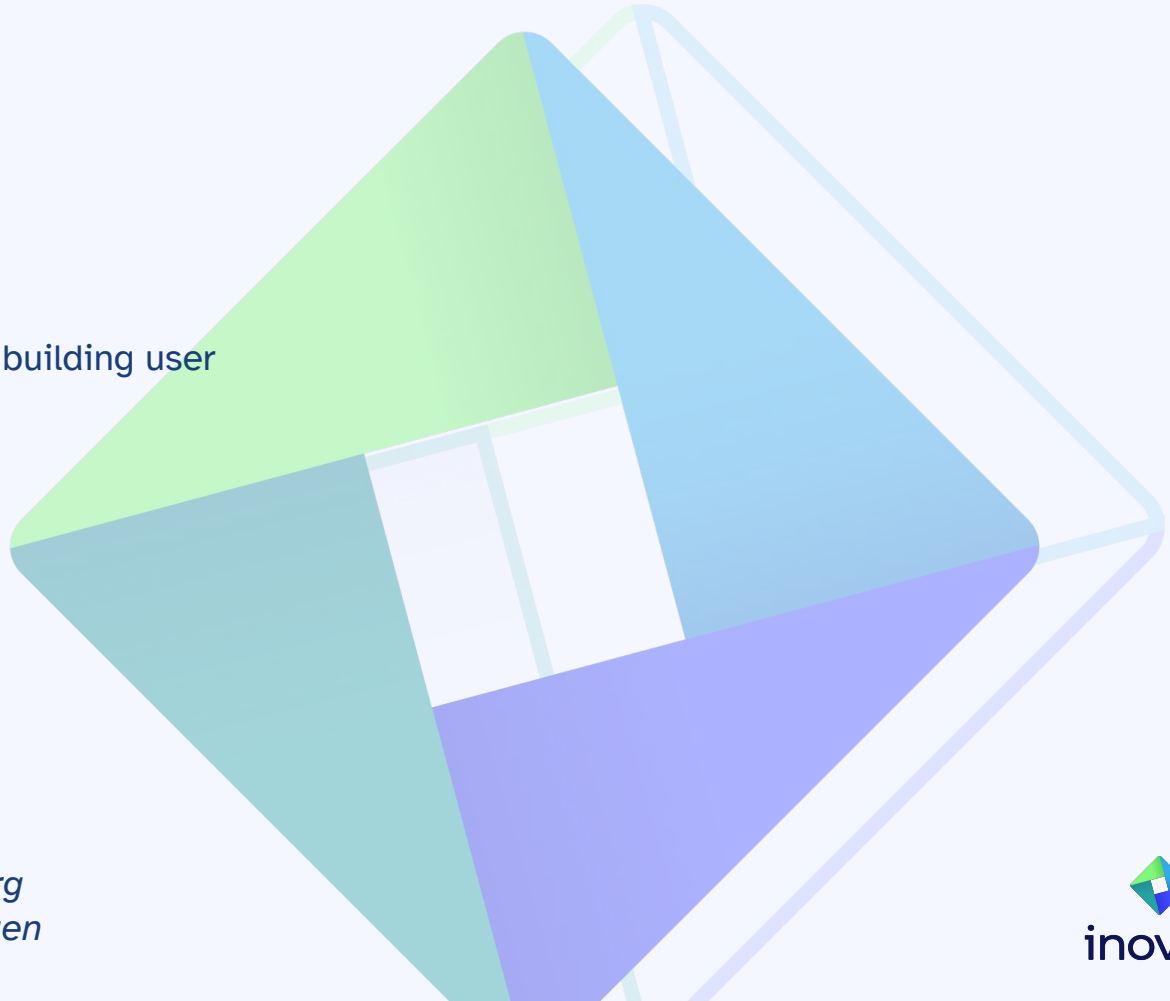
SolidJS

Simple and performant reactivity for building user interfaces



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Focus:

- Web
- Security

JSCC23 Organizer

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June 30th & July 1st in Munich

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Agenda

- SolidJS Reactivity
- JSON Web Token
- Component Props
- Control Flow
- Stores
- Async

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SolidJS Basics

Components, Reactivity & more

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What is SolidJS?

- Performant
- Powerful
- Pragmatic
- Productive

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Performant

Name Duration for...	vanillajs	solid-v1.5.4	vue-v3.2.47	svelte-v3.58.0	angular-v15.0.1	react-v18.2.0
Implementation notes	772					
Implementation link	code	code	code	code	code	code
create rows creating 1,000 rows (5 warmup runs).	37.9 ±0.4 (1.07)	36.4 ±0.2 (1.03)	42.0 ±0.7 (1.18)	48.4 ±0.1 (1.37)	45.7 ±0.5 (1.29)	47.5 ±0.6 (1.34)
replace all rows updating all 1,000 rows (5 warmup runs).	38.4 ±0.3 (1.00)	40.7 ±0.3 (1.06)	44.8 ±0.5 (1.17)	51.4 ±0.7 (1.34)	48.2 ±0.6 (1.25)	52.8 ±0.3 (1.37)
partial update updating every 10th row for 1,000 rows (3 warmup runs). 16 x CPU slowdown.	88.4 ±2.3 (1.01)	90.4 ±2.0 (1.03)	103.5 ±3.4 (1.18)	103.0 ±3.0 (1.17)	96.7 ±2.5 (1.10)	128.1 ±3.0 (1.46)
select row highlighting a selected row. (5 warmup runs). 16 x CPU slowdown.	11.8 ±1.3 (1.24)	13.1 ±1.0 (1.37)	22.1 ±1.3 (2.31)	15.8 ±1.3 (1.65)	15.6 ±1.0 (1.64)	39.3 ±0.6 (4.12)
swap rows swap 2 rows for table with 1,000 rows. (5 warmup runs). 4 x CPU slowdown.	25.0 ±0.8 (1.01)	28.7 ±0.5 (1.16)	29.0 ±0.8 (1.17)	27.6 ±0.9 (1.11)	166.0 ±1.0 (6.71)	163.5 ±0.7 (6.61)
remove row removing one row. (5 warmup runs). 4 x CPU slowdown.	38.8 ±0.9 (1.01)	39.6 ±1.1 (1.03)	45.8 ±1.1 (1.20)	41.1 ±1.1 (1.07)	42.3 ±1.2 (1.10)	47.7 ±1.3 (1.25)
create many rows creating 10,000 rows. (5 warmup runs with 1k rows).	398.2 ±1.7 (1.00)	420.5 ±3.5 (1.06)	475.3 ±1.5 (1.19)	524.0 ±3.6 (1.32)	474.2 ±1.9 (1.19)	661.5 ±2.4 (1.66)
append rows to large table appending 1,000 to a table of 10,000 rows. 2 x CPU slowdown.	82.2 ±0.6 (1.00)	85.4 ±0.5 (1.04)	94.7 ±0.8 (1.15)	109.1 ±0.4 (1.33)	101.7 ±0.8 (1.24)	115.0 ±0.7 (1.40)
clear rows clearing a table with 1,000 rows. 8 x CPU slowdown. (5 warmup runs).	29.2 ±0.7 (1.02)	34.5 ±0.6 (1.20)	34.7 ±1.2 (1.21)	40.5 ±1.0 (1.41)	61.1 ±1.7 (2.13)	37.9 ±1.0 (1.32)
geometric mean of all factors in the table	1.04	1.10	1.27	1.30	1.60	1.87

Source: https://krausest.github.io/js-framework-benchmark/2023/table_chrome_114.0.5735.90.html

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Essentials of SolidJS Components

- **JSX Syntax**: good support in all editors & TypeScript
- **Component Composition:** Nested and reusable components
- **Rerender Control:** executed once - only the parts of the UI that are affected by the change will be updated
- **Component Lifecycle: `onMount` & `onCleanup`**

```
function MyButton() {
 return (<button>I'm a button</button>);
}

export default function MyApp() {
  onMount(() =>
    console.log("app mounted")
  );
  return (
   <div>
     <h1>Welcome to my app</h1>
     <MyButton />
   </div>
 );
}
```


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Reactivity: Signals

- `createSignal` is the basic building block
- returns a *getter* and *setter* function
- SolidJS tracks signal *getter* usage in components
- on *setter* usage, all depended components are updated
- updates are fine-grained and do not force a component rerender

```
function Counter() {
  const [count, setCount] = createSignal(1);
  const increment = () =>
    setCount(count() + 1);

  return (
  <button type="button" onClick={increment}>
    {count()}
  </button>
  );
}
```


Source: https://www.solidjs.com/tutorial/introduction_signals

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Derived Signals

- Functions wrapping signals also behave as signals.
- Reactivity Source: Derived signals gain reactivity from accessed signals.

```
function Counter() {
  const [count, setCount] = createSignal(0);
  const doubleCount = () => count() * 2;
  setInterval(() => setCount(count() + 1), 1000);
  return <div>Count: {doubleCount()}</div>;
}
```


Source: https://www.solidjs.com/tutorial/introduction_derived

createEffect

- Run side effects when dependencies change
- Dependencies: Signals, Memos, Props, Stores
- Effects are meant primarily for side effects that read but don't write to the reactive system

```
function Counter() {
  const [count, setCount] = createSignal(0);
  createEffect(() => {
    console.log("The count is now", count());
  });
  return <button onClick={() => setCount(count() + 1)}>Click Me</button>;
}
```


Source: https://www.solidjs.com/tutorial/introduction_effects

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createMemo

- Memos are both an observer, like an effect, and a read-only signal
- Run only once for any change
- Cache values in order to reduce duplicated work

```
function Counter() {
  const [count, setCount] = createSignal(1);
  const fib = createMemo(() => {
    console.log('Calculating Fibonacci');
    return fibonacci(count());
  });
  return <button onClick={() => setCount(count() + 1)}>{fib()}{fib()}</button>;
}
```


Source: https://www.solidjs.com/tutorial/introduction_memos

JSON Web Token

Short JWT introduction

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JSON Web Tokens (JWT)

- **JWT Definition**: Digitally signed tokens for secure data exchange.
- **Self-contained**: Encodes all relevant information within the token.
- **Usage**: Primarily for authentication and secure information exchange.
- **Scalable Authorization**: Stateless design reduces server load.
- **Data Transmission**: Flexible, supports claims for multiple parties.

Structure of a JWT

- **Header**: Defines token type (JWT) and signing algorithm used.
- **Payload**: Contains claims or pieces of information about the entity.
- **Signature**: Ensures the sender's identity and data integrity.
- **Encoding**: Each part Base64Url encoded, separated by periods.
- **Format**: encodedHeader.encodedPayload.signature for a complete JWT.

Example:

```
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9
.eyJzdWIiOiI0MiIsIm5hbWUiOiJBcnRodXI
iLCJpYXQiOjE1MTYyMzkwMjJ9.kxQ5yjGcYt
_H_uDihzbrx9G7sAQP9rdhl_sc0VgtUrM
```

```
{
  "alg": "HS256",
  "typ": "JWT"
}
{
  "sub": "42",
  "name": "Arthur",
  "iat": 1516239022
}
```


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JWT Usage

JWT are typically send with every request in the *Authorization* HTTP header as *Bearer Token*.

Example:

```
curl -X GET \
     -H "Authorization: Bearer eyJhbG…VgtUrM" \
     https://example.com/api/resource
```


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JWT Disclaimers

- 🤫 Treat JWT as secrets and never paste them into websites
- 👀 Use local tools (you trust) to explore JWTs
- ⛔ Do not implement verification yourself
- 🤔 Token revocation is a hard problem
- 🚚 Big JWT increase the size of every request

Exercise 1: Signals & Effects

1. `git clone https://github.com/meldron/solid-jwt-workshop.git`
2. Follow setup and run instructions
3. Open **`src/App.tsx`** and add reactivity to **Token** text area so that new Tokens update Header, Payload & co
4. Bonus: verify Token

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Component Props & Control FLow

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Component Properties

- Props: readonly reactive properties passed to components
- Consistent Form: unchanged by signals, expressions, or static values
- Access Method: utilized via `props.propName`
- Avoid Destructuring ❗ : Prevents reactivity loss outside tracking scope
- Utility Functions: merge/split reactive objects, preserving reactivity

Source: https://www.solidjs.com/tutorial/props_defaults

Component Properties Example

```tsx
interface GreetingProps {
  name: string;
  age?: number;
}

const Greeting: Component<GreetingProps> = (props) => {
  const merged = mergeProps({ age: 42 }, props);
  return (
    <div>
      <p>Hello, my name is {merged.name}.</p>
      <p>I am {merged.age} years old.</p>
    </div>
  );
};
```

```tsx
<Greeting name="Bernd"/>
```

renders as

```
Hello, my name is Bernd.
I am 42 years old.
```


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Control Flow

- Solid provides several control flow components: **`Show`**, **`For`**, **`ErrorBoundary`**, `Switch` / `Match`, `Index`, `Suspense`, `Dynamic`, `Portal`
- Should be preferred over JS control flow (e.g., `Array.map`)
  - **Fine-grained Reactivity**: Only affected components rerender.
  - **Memory Efficiency**: Automatic cleanup of signal listeners.
  - **Syntax Consistency**: Embed control logic directly in JSX.
  - **Keyed Updates**: Better tracking and handling of lists

Show Component

- Conditionally renders children, if the when condition is true
- When used with a callback, the callback is only executed, if the condition is null asserted
- Optionally can be keyed to a specific data model => the function is re-executed whenever the model is replaced

```
<Show when={merged.age > 17}
      fallback={<div>Loading...</div>}>
  <div>My Mature Content</div>
</Show>

<Show when={merged.user}
      fallback={<div>Loading...</div>}>
  {(user) => <div>{user.name}</div>}
</Show>

<Show when={merged.user}
      keyed>
  {(user) => <div>{user.name}</div>}
</Show>
```


Source: https://www.solidjs.com/tutorial/flow_show

`For` Component

- Iterates over lists for rendering
- Accepts an `each` and `fallback` prop
- The callback takes the current item as the first argument
- The optional second argument is an *index* signal
- On a list change, updates or moves items in the DOM

```
<For each={merged.users}
     fallback={<div>Loading...</div>}>
  {(item, index) => (
    <div>
      #{index()} {item.name} - {item.age}
    </div>
  )}
</For>
```


Source: https://www.solidjs.com/tutorial/flow_for

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`ErrorBoundary` Component

- Catches uncaught errors and renders fallback content
- Also supports callback form which passes in error and a reset function.

```
<ErrorBoundary
  fallback={<div>My Bad</div>}>
  <Greeting name="Test"/>
</ErrorBoundary>

<ErrorBoundary
  fallback={
    (err, reset) =>
    <div onClick={reset}>
      Error: {err.toString()}
    </div>
  }>
  <Greeting name="Test"/>
</ErrorBoundary>
```


Source: https://www.solidjs.com/tutorial/flow_error_boundary

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Exercise 2: Refactor into Components

- Refactor the app into multiple components with props
  - TokenInput
  - Header
  - Payload
  - ...
- Use Control Flow Components to enhance the user experience
  - For loop over header properties / values
  - Show an error message if the JWT is invalid (not set)
  - ...
- Use `.tsx` as file extension for components
- Bonus: verify token only for HS256 JWTs

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Stores

How to make your life easier

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Stores

- Stores are proxy objects supporting nested reactivity
- Signals are created as needed under tracking scopes
- `createStore` returns a readonly store proxy and a setter function
- Merges new properties with state and supports nested updates
- **Path Syntax**: Allows powerful iteration, range capabilities and granular reactivity

```
const [todos, setTodos] =
  createStore([]);

const addTodo = (text) => {
  setTodos(
    [...todos,
    { id: ++todoId,
      text,
      completed: false
    }]);
}

const toggleTodo = (id) => {
  setTodos(
    todo => todo.id === id,
    "completed",
    completed => !completed
  );
}
```


Source: https://www.solidjs.com/tutorial/stores_createstore

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Store Mutations

- Solid strongly recommends the use of shallow immutable patterns for updating state
- **`produce`** is and an Immer inspired store modifier
- **`produce`** mutates writable proxy version of the Store

```
const [todos, setTodos] =
  createStore([]);
const addTodo = (text) => {
  setTodos(
    produce((todos) => {
      todos.push(
        { id: ++todoId,
          text,
          completed: false
        }
      );
    }));
};
const toggleTodo = (id) => {
  setTodos(
    todo => todo.id === id,
    produce((todo) =>
     (todo.completed =
        !todo.completed)),
  );
};
```


Source: https://www.solidjs.com/tutorial/stores_mutation

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Exercise 3: add Stores

- Add store(s) in separate file(s) (use `.ts` file extension)
- Use store in your components to pass state around

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Async

Promises & other lazy Stuff

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`createResource`

- **`createResource`** provides simple and efficient data-fetching.
- Streamlines handling of async operations in UI.
- Automatically handles component re-render on data change.
- Built-in suspense and error boundary support.

```
const [data, { refetch }] =
  createResource(requestToken);

return (
<>
  <Show when={data()}>{data()}</Show>
  <Show when={data.loading}>⏳</Show>
  <Show when={data.error}>
      ⚠️ {data.error.message}
  </Show>
</>
);
```


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More Async Helper

- `lazy`: Allows dynamic import of components to supports code splitting
- `Suspense`: coordinating multiple async events, eliminating partial loading states, and offering fallback during resolvement
- `SuspenseList`: allows grouping and ordering the reveal of loaded `Suspense` components
- `useTransition:` maintaining current view until all asynchronous events are complete

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Exercise 4: Async Calls

- `cd` into token-server/ and run `npm run start`
- Explore `src/facts.ts`
- Use a `createResource` to load a JWT with `requestToken`
- Use `getFact` with the loaded JWT to receive a animal fact
- Display animal fact

Thank you!

inovex is an IT project center driven by innovation and quality, focusing its services on ‘Digital Transformation’.

- founded in 1999
- 500+ employees
- 8 offices across Germany

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