React Fundamentals

tsevdos.me / @tsevdos

Agenda

All the content can be found here.

- what is react
- core principles
- JSX
- components

Rules

Feel free to interrupt me for:

- questions
- relevant comments

What is React

React is a library for building user interfaces.

- virtual DOM
- JSX
- event handling
- performance

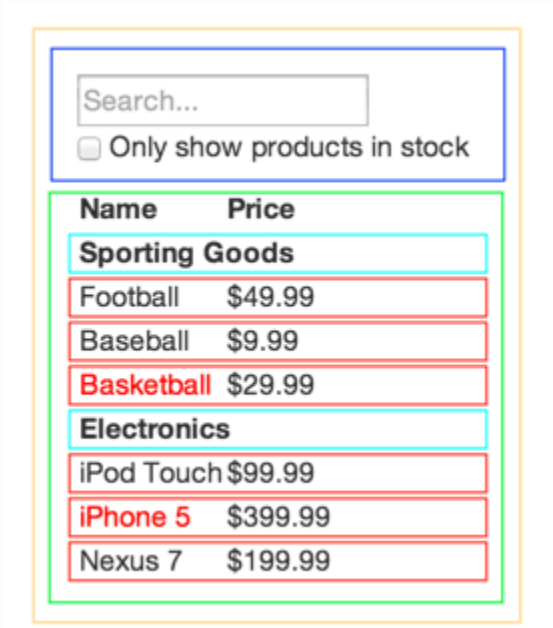
Core principles

- composition
- declarative
- unidirectional dataflow
- explicit mutations

Composition

- divide and conquer
- hide complexity
- comes from functional programming

Composition



Composition

```
<Widget>
  <SearchForm />
  <Results>
    <Header />
    <SportsTable />
    <ElectronicsTable />
  </Results>
</Widget>
```

Composition

twitter.com example

- how UI is going to look
- state

Avatar sample code

```
function getProfilePhoto(username) {
  return "https://twitter.com/photos/" + username;
}

function getProfileLink(username) {
  return "https://twitter.com/" + username;
}

function getAvatar(username) {
  return {
    photo: getProfilePhoto(username),
    link: getProfileLink(username),
  };
}

getAvatar("tsevdos");
```

Avatar (React code)

```
const ProfilePhoto = (props) {
  return <img src={"https://twitter.com/photos/" + props.username} />;
}

function ProfileLink(props) {
  return (
    <a href={"https://twitter.com/" + props.username}>
      { props.username }
    </a>
  );
}
...
```

Avatar (React code)

```
...
function Avatar(props) {
  return (
    <div>
      <ProfilePhoto username={props.username} />
      <ProfileLink username={props.username} />
    </div>
  );
}

<Avatar username="tsevdos" />
```

Imperative and Declarative

- imperative programming is a programming paradigm that uses statements that change a program’s state
- declarative programming is a programming paradigm that expresses the logic of a computation without describing its control flow

Imperative (How)

```
var numbers = [1, 2, 3, 4, 5];
var total = 0;

for (var i = 0; i < numbers.length; i++) {
  total += numbers[i];
}
```

Declarative (What)

```
var numbers = [1, 2, 3, 4, 5];
var total = numbers.reduce((total, item) => {
  return total + item;
}, 0);
```

JavaScript built in methods

- map
- reduce
- filter
- find

Declarative

- reduce side effects and mutability
- more clear / readable code
- less errors / bugs

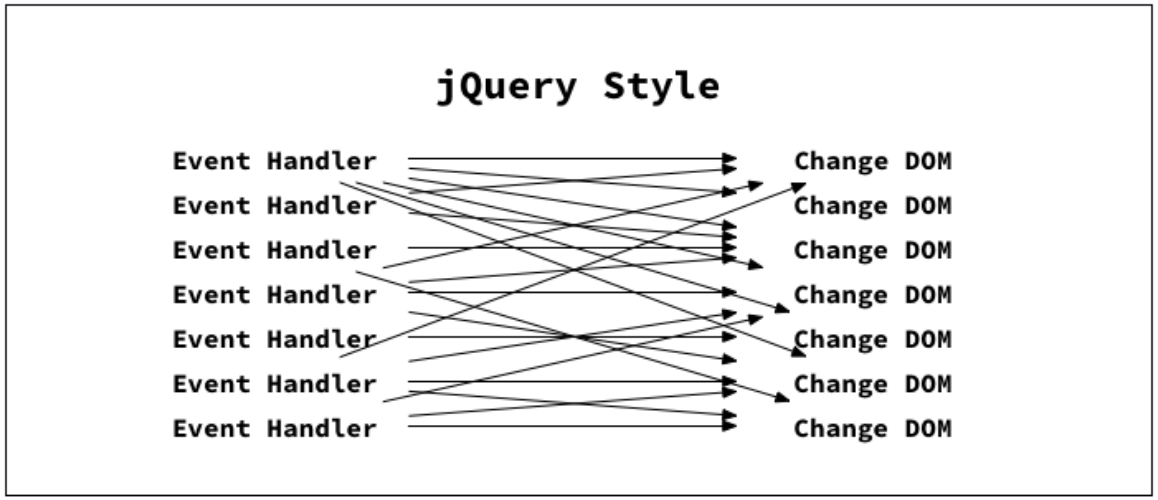
React is declarative

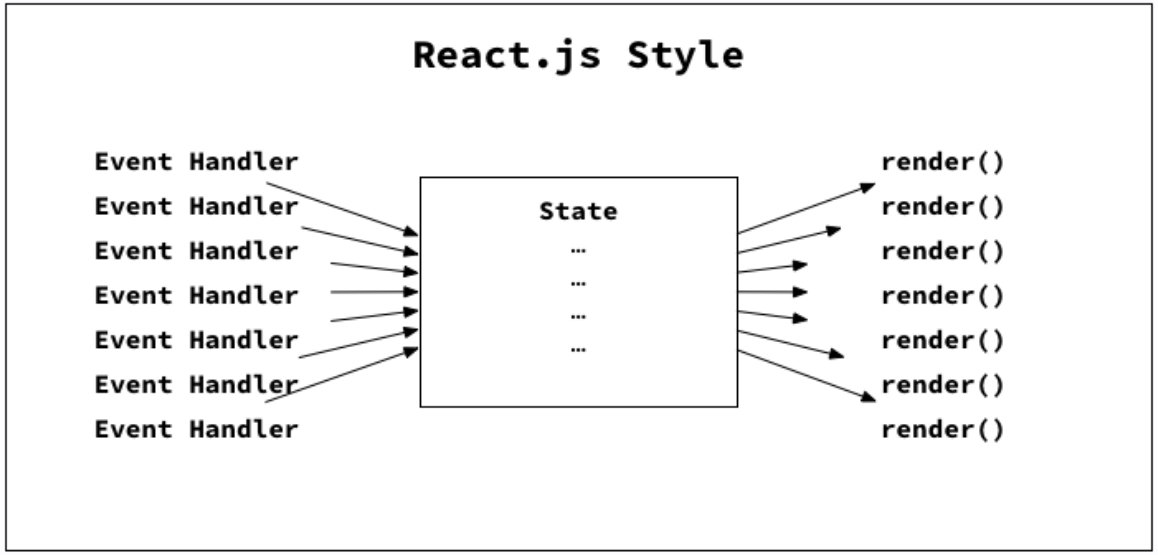
```
$("#btn").click(function () {
  $(this).toggleClass("active");
  if ($(this).text() === "Active") {
    $(this).text("Inactive");
  } else {
    $(this).text("Active");
  }
});
```

```
<Button onClick="handleClick" isActive={isActive} />;

setIsActive(!isActive);
```

Unidirectional dataflow





Explicit mutations

```
setName("John");
```

Rendering elements

- React.createElement
- JSX
- virtual DOM

DOM scripting: document.createElement

```
// file workshop/JSX/00.html

<html>
  <head></head>
  <body>
    <div id="app"></div>
    <script type="text/javascript">
      const rootElement = document.getElementById("app");
      const element = document.createElement("div");
      element.textContent = "Hello World";
      element.className = "container";
      rootElement.appendChild(element);
...
```

React.createElement

```
// file workshop/JSX/01.html

const rootElement = document.getElementById("app");
const element = React.createElement(
  "div",
  { className: "container" },
  "Hello World"
);

ReactDOM.render(element, rootElement);
```

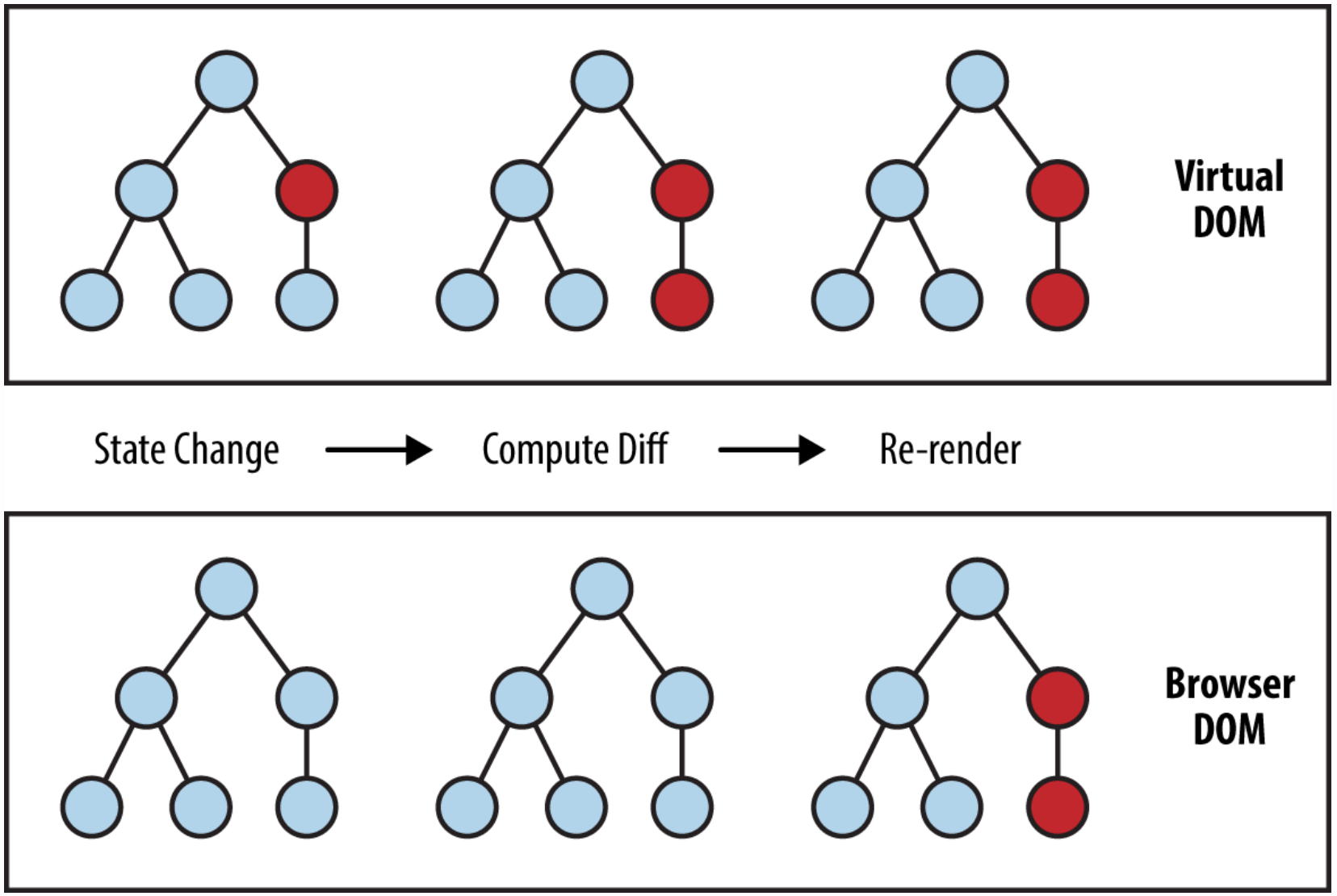
React.createElement

```
React.createElement(type, [props], [...children]);
```

Virtual DOM

The virtual DOM (VDOM) is an in-memory representation of real DOM. The representation of a UI is kept in memory and synced with the “real” DOM. It’s a step that happens between the render function being called and the displaying of elements on the screen. This entire process is called reconciliation.

Virtual DOM


Virtual DOM
State Change
Compute Diff
Re-render
Browser DOM

React.createElement

```
// file workshop/JSX/02.html

const element = React.createElement(
  "div",
  { className: "container" },
  React.createElement("div", null, "Div 1"),
  React.createElement(
    "div",
    null,
    React.createElement("h2", null, "Title"),
    React.createElement("p", null, "Paragraph inside div 2")
  )
);
```

JSX

```
// file workshop/JSX/03.html

// const element = React.createElement(
//   "div",
//   { className: "container" },
//   "Hello World"
// );

const element = <div className="container">Hello World</div>;
```

JSX

```
// file workshop/JSX/04.html

const element = (
  <div className="container">
    <div>Div 1</div>
    <div>
      <h2>Title</h2>
      <p>Paragraph inside div 2</p>
    </div>
  </div>
);
```

JSX interpolation

```
// file workshop/JSX/05.html

const title = "Hello World";
const myClassName = "container";

const element = <div className={`${myClassName}-1`}>{title}</div>;
```

Babel transpilation / compilation

- example

Components

- functional components
- props
- children
- conditional rendering

Components

A component is a function or a class which optionally accepts input and returns a React element (or null).

Still JSX (no components)

```
// file workshop/components/00.html

const element = (
  <div classname="container">
    <div>Hello World</div>
    <div>Hello World</div>
  </div>
);
```

Still JSX (no components)

```
// file workshop/components/01.html

const myDiv = <div>Hello World</div>;

const element = (
  <div classname="container">
    {myDiv}
    {myDiv}
  </div>
);
```

Our first functional reusable component

```
// file workshop/components/02.html

const MyDiv = (props) => {
  return <div>{props.msg}</div>;
};

const element = (
  <div className="container">
    <MyDiv msg="Hello World" />
    <MyDiv msg="Welcome to Code.Hub" />
  </div>
);
```

Component rules

User-defined components must be capitalized in JSX (lower-case tag names are considered to be HTML tags).

- <mydiv /> compiles to React.createElement('mydiv') (html tag)
- <Mydiv /> compiles to React.createElement(Mydiv)

Functional component transpilation

- Babel example

Components and children

```
// file workshop/components/03.html

const MyDiv = (props) => {
  return <div>{props.children}</div>;
};

const element = (
  <div className="container">
    <MyDiv>Hello World</MyDiv>
    <MyDiv>
      Welcome to Code.Hub
      <MyDiv>Hi I'm a component</MyDiv>
    </MyDiv>
...
```

Children

Props.children displays whatever you include between the opening and closing tags when invoking a component.

- freedom and composition
- almost everything can be a child (element, component and function)

Functional components

```
// example components/04.html

const Avatar = (props) => {
  return (
    <div>
      <h3>{props.username}</h3>
      <img width="100" src={props.imgUrl} />
      <p>My age is {props.age}</p>
      <p>My hobbies are:</p>
      <ul>
        {props.hobbies.map((hobbie) => (
          <li key={hobbie}>{hobbie}</li>
        ))}
      </ul>
...
```

Valid props

- string
- number
- boolean
- array
- object
- function
- symbol

Functional components

```
// example components/05.html

<Widget
  title="Website traffic"
  logo="https://image.flaticon.com/icons/svg/148/148767.svg"
  data={data}
/>
```

Functional components

```
// example components/06.html

<div>
  <Widget
    title="Website traffic"
    logo="https://image.flaticon.com/icons/svg/148/148767.svg"
    data={data}
  />
  <Widget
    title="Website errors"
    logo="https://image.flaticon.com/icons/svg/148/148836.svg"
    data={data2}
  />
</div>
```

Functional components

```
// example components/07.html

const Widget = (props) => {
  return (
    <div>
      <h2>{props.title}</h2>
      <img width="30" height="30" src={props.logo} />
      {props.data.map((entry) => (
        <WidgetEntryItem key={entry.title} {...entry} />
      ))}
    </div>
  );
};
```

Conditional rendering: If/Else

```
// example components/08.html

const User = ({ username }) => {
  if (username) {
    return <div>Hello, {username}</div>;
  }

  return <div>Hi stranger!</div>;
};
```

Conditional rendering: Ternary operator

```
// example components/09.html

const User = ({ username }) => {
  return (
    <div>
      {username ? <span>Hello, {username}</span> : <span>Hi stranger!</
    </div>
  );
};
```

Conditional rendering: Ternary operator

```
// example components/10.html

const User = ({ username }) => {
  return (
    <div>
      {username ? (
        <React.Fragment>Hello, {username}</React.Fragment>
      ) : (
        <React.Fragment>Hi stranger!</React.Fragment>
      )}
    </div>
  );
};
```

Conditional rendering: Short-circuit operator (&&)

```
// example components/11.html

const FavoriteColorsList = ({ list }) => {
  return (
    <div>
      {list.length > 0 && (
        <div>
          {list.map((color) => (
            <span key={color}>{color}, </span>
          ))}
        </div>
      )}
...
```

Conditional rendering: Element variables

```
// example components/12.html

const User = ({ isLoggedIn }) => {
  let button;

  if (isLoggedIn) {
    button = <button>Logout</button>;
  } else {
    button = <button>Login</button>;
  }

  return <div>{button}</div>;
};
```

Components

- functional components
- state
- hooks
- event handlers

Components

A component is a function or a class which optionally accepts input and returns a React element (or null).

Component state

```
// example state/00.html

const LikeCount = () => {
  const [counter, setCounter] = React.useState(0);
  const handleLike = () => {
    setCounter(counter + 1);
  };

  return (
    <div>
      <div className="emoji">💓 {counter}</div>
      <button onClick={handleLike}>Like!</button>
    </div>
  );
};
```

useState hook

useState hook enqueues changes to the component state and tells React that this component and its children need to be re-rendered with the updated state. This is the primary method you use to update the user interface in response to event handlers and server responses.

Component state

```
// example state/01.html

const LikeCount = () => {
  const [counter, setCounter] = React.useState(0);
  const handleLike = () => {
    setCounter((counter) => counter + 1);
  };
  const handleDislike = () => {
    setCounter((counter) => counter - 1);
  };
...
```

Use useState hook correctly

- Only update the state with the appropriate function
- State updates may be asynchronous (React may batch multiple setState() calls into a single update for performance)

Use useState hook correctly

```
// Wrong
counter = 5; // this will not re-render a component
// Correct
const [counter, setCounter] = React.useState(0);
setCounter(5);

// Might cause a problem
setCounter(counter + 1);
// Correct
setCounter((counter) => counter + 1);
```

Do not mutate the state

```
// example state/02.html

const changeName = () => {
  const newProfile = profile;
  profile.user.name = "New Name";
  // console.log(newProfile);
  setProfile(newProfile);
};
```

Updating the state correctly

```
// example state/03.html

const changeName = () => {
  setProfile((profile) => ({
    ...profile,
    user: {
      ...profile.user,
      name: "New Name",
    },
  }));
};
```

Updating the state correctly

Immutable tricks for arrays and objects

```
// Arrays
// Spread Operator (ES6)
setState([...arr, "new value"]);
// Array.prototype.slice() (ES5)
const newArr = arr.slice();
newArr.push("new value");
setState(newArr);

// Objects
// Spread Operator (ES6)
setState({ ...user, name: "New Name" });
// Object.assign (ES6)
const newUser = Object.assign({}, user);
```

Using state

The state of one component can be the props of another one.

```
// example state/04.html

const Form = () => {
  ...

  return (
    <div>
      <Hello name={name} />
      <input type="text" name="name" onChange={handleOnChange} />
    </div>
  );
};
```

Components and events

- SyntheticEvent
- cross-browser wrapper around the browser’s native event
- it has the same interface as the browser’s native event, including stopPropagation() and preventDefault()
- you have access to the native event using event.nativeEvent

Components and events

- react events are named using camelCase, rather than lowercase
- supported events

Styling and CSS

- CSS classes
- in-line styles

CSS classes

```
// example styling-and-css/00.html

const MyComponent = (props) => {
  return (
    <div className="columns">
      <div className="column">
        <p className="has-background-primary has-text-white">First colu
      </div>
      <div className="column">
        <p className="has-background-primary has-text-white">Second col
      </div>
...
```

CSS classes

```
// example styling-and-css/01.html

const MyComponent = (props) => {
  const columnclassName = "column";
  const paragraphClassName = "has-background-primary has-text-white";

  return (
    <div className="columns">
      <div className={columnclassName}>
        <p className={paragraphClassName}>First column</p>
      </div>
      <div className={columnclassName}>
        <p className={paragraphClassName}>Second column</p>
      </div>
...
```

In-line styles

```
// example styling-and-css/02.html

const firstParagraphStyle = {
  padding: "0.5em 1em",
  fontSize: "1.4em",
  background: "hsl(217, 71%, 53%)",
  color: "#fff",
};

const MyComponent = (props) => {
  const columnclassName = "column";
  const paragraphClassName = "has-background-primary has-text-white";

  return (
    <div className="columns">
      <div className={columnclassName}>
...
```

React and styling is a huge topic

- CSS Stylesheet
- Inline styling
- CSS Modules
- CSS-in-JS

Recap

- what is react
- core principles
- JSX
- components

Recap: Core principles

- composition
- declarative
- unidirectional dataflow
- explicit mutations

Recap: Basics

- React.createElement
- JSX
- virtual DOM

Recap: Components

- props
- state
- hooks
- children
- conditional rendering
- event handlers

Recap: Styling and CSS

- CSS classes
- In-line styles

That's all folks

Questions / Discussions?