ReactJS.

The Component model (Contd)

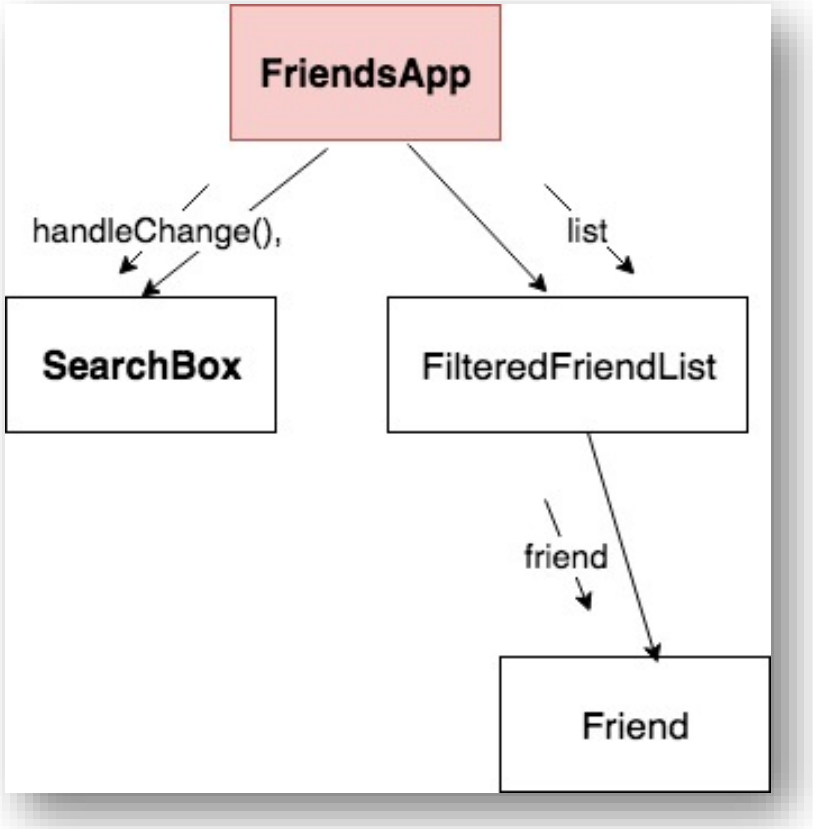
Topics

- **More Hooks and Component Lifecycle.**
- **Data Flow patterns – Data Down, Action Up pattern.**
- **The Virtual DOM**

Sample App 1 – Version 2

- **App UI changes:**
  1. **A ‘Reset’ button – loads a new list of friends (overwriting the current list).**
  2. **Combine Reset button and search text into a new component, SearchBox.**
  3. **Browser tab title - shows # of matching friends (side effect).**
- **Ref. lecture archive for source code**

Sample App 1 (v2) - Design

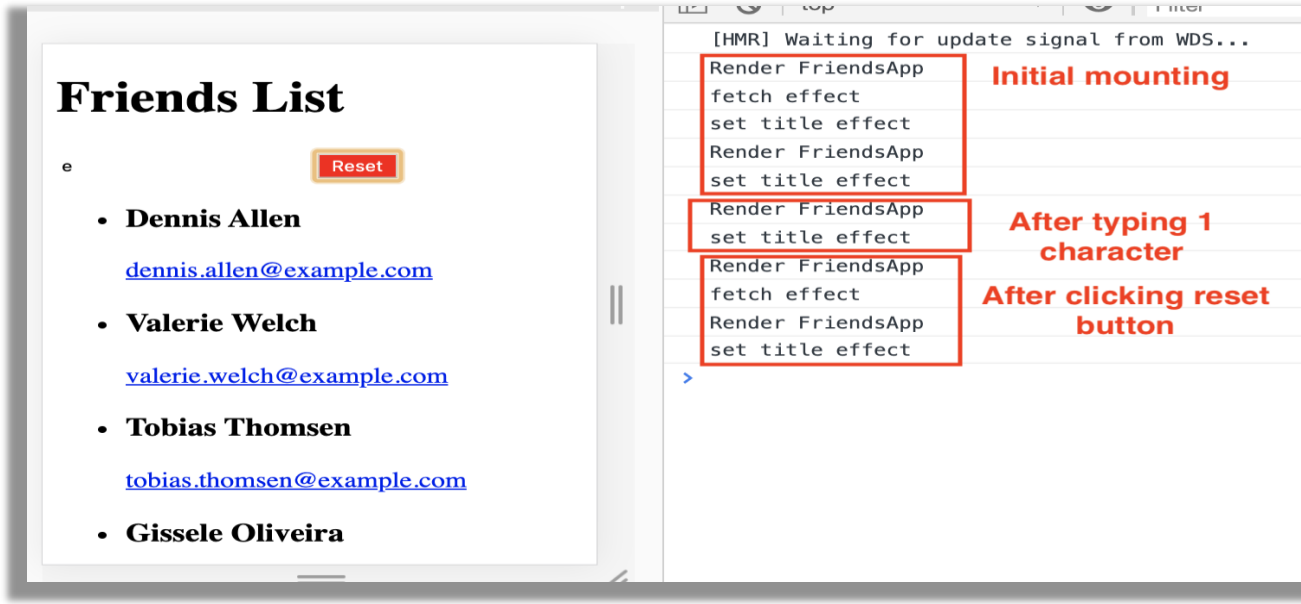


- **3 state variables:**
  1. **List of friends from API.**
  2. **Text box content.**
  3. *Reset button toggle.*

- **2 side effects, both with dependency arrays:**
  1. **'Fetch API data' -** reset button **toggle dependency.**
  2. **'Set browser tab title' - matching list length dependency.**

Sample App 1 (v2) - Events.

- **On mounting of** FriendsApp **component:**
  Both effects execute (Set browser tab to ’0 matches’).
  - → **‘Fetch data’ effect initializes ‘friends list’ state.**
  - → **Component re-renders → ‘Set browser tab’ effect executes.**
- **On typing a character in the text box:**
  ‘Text box’ state changes.
  - → FriendsApp **rerenders + recomputes matching friends list**
  - → **‘Set browser title’ effect executes.**
- **On clicking Reset button:**
  ‘Reset toggle’ state changes.
  - → FriendsApp **re-renders.**
  - → **‘Fetch data’ effect executes.**
  - → **‘Friends list’ state changes.**
  - → **FriendsApp re-renders + recomputes matching list**
  - → **‘Set browser title’ effect executes.**



Topics

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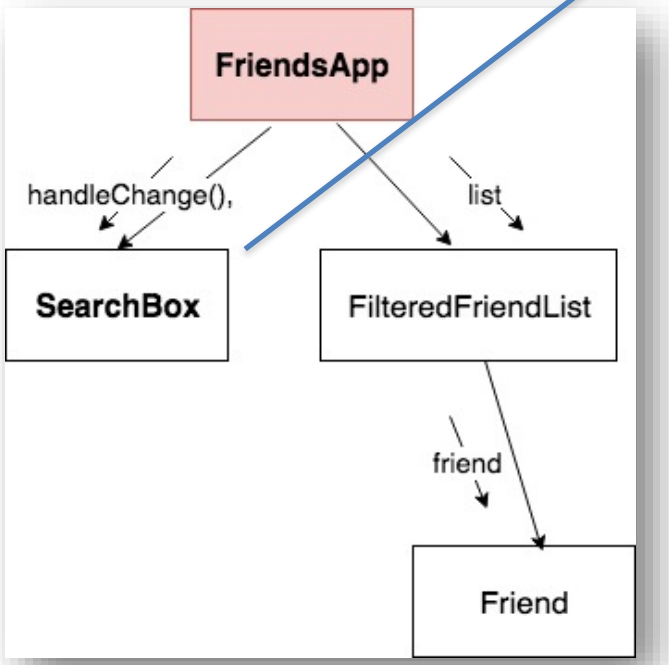
Sample App 2

(Data down, actions up pattern or Inverse data flow pattern)

- **Often a component's** state change **is caused by an** event **in a subordinate component.**
- **Solution: Use the** data down, action up pattern.

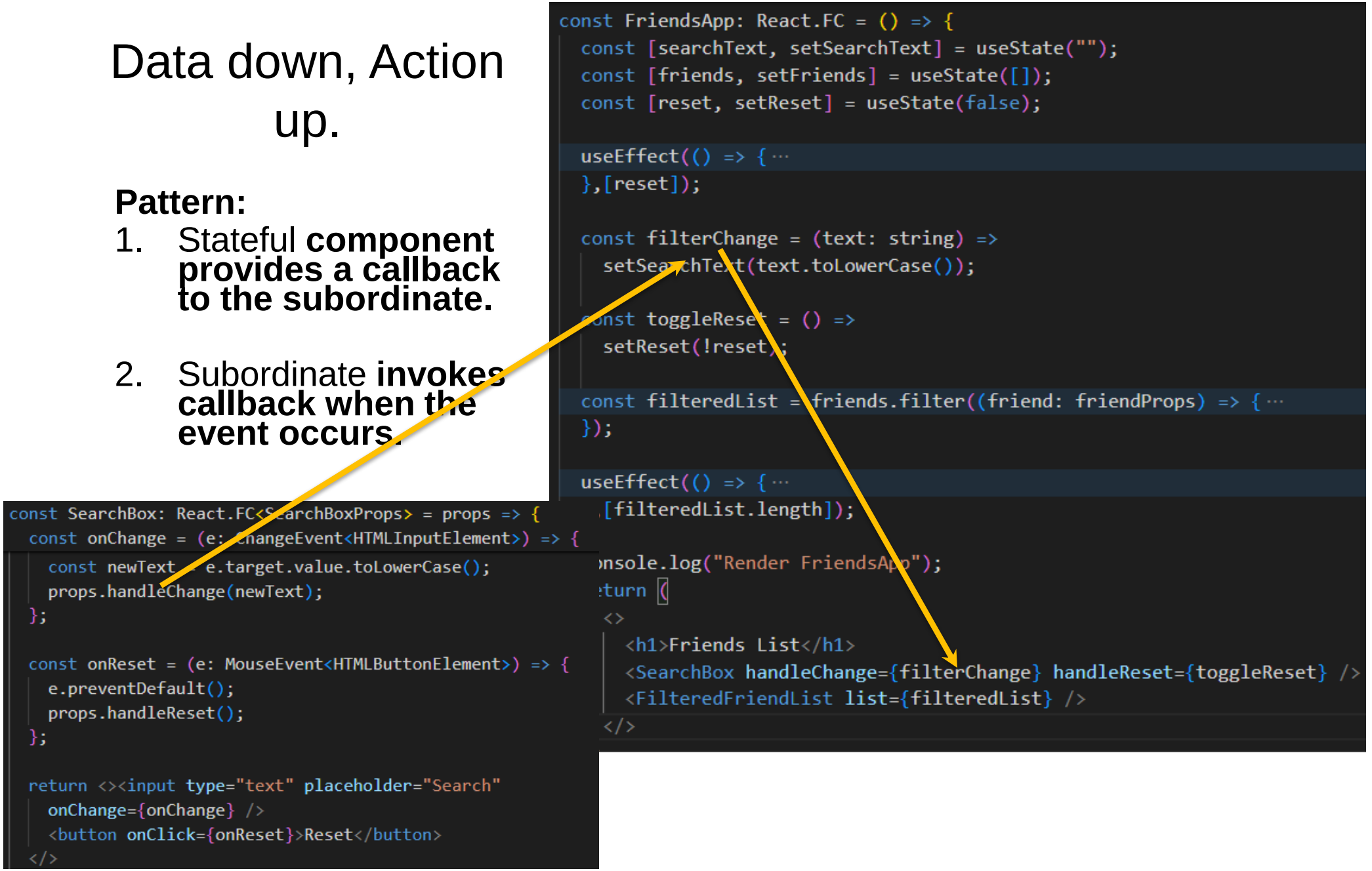


Data down, Action up.

Pattern:

1. Stateful **component provides a callback to the subordinate.**

2. Subordinate **invokes callback when the event occurs.**



```tsx
const FriendsApp: React.FC = () => {
  const [searchText, setSearchText] = useState("");
  const [friends, setFriends] = useState([]);
  const [reset, setReset] = useState(false);

  useEffect(() => {···
  },[reset]);

  const filterChange = (text: string) =>
    setSearchText(text.toLowerCase());

  const toggleReset = () =>
    setReset(!reset);

  const filteredList = friends.filter((friend: friendProps) => {···
  });

  useEffect(() => {···
  [filteredList.length]);

  nsole.log("Render FriendsApp");
  turn (
  <>
    <h1>Friends List</h1>
    <SearchBox handleChange={filterChange} handleReset={toggleReset} />
    <FilteredFriendList list={filteredList} />
  </>
```

```tsx
const SearchBox: React.FC<SearchBoxProps> = props => {
  const onChange = (e: ChangeEvent<HTMLInputElement>) => {
    const newText = e.target.value.toLowerCase();
    props.handleChange(newText);
  };

  const onReset = (e: MouseEvent<HTMLButtonElement>) => {
    e.preventDefault();
    props.handleReset();
  };

  return <><input type="text" placeholder="Search"
    onChange={onChange} />
    <button onClick={onReset}>Reset</button>
  </>
```

Handling Events in Code: React Event Handlers in Typescript

- Event handlers designed for value changes/mouse events atc.
- Event handler signature:
  - one argument, e, which has a corresponding generic type supplied by React Typescript libraries

event object that contains information about a change event on an HTML input element (e.g. textbox).

event object that contains information about a mouse event on an HTML button element.

```
const onChange = (e: ChangeEvent<HTMLInputElement>) => {
  e.preventDefault();
  const newText = e.target.value.toLowerCase();
  props.handleChange(newText);
};
```

```
const onReset = (e: MouseEvent<HTMLButtonElement>) => {
  e.preventDefault();
  props.handleReset();
};
```

```
return
<>
  <input type="text" placeholder="Search" onChange={onChange} />
  <Button onClick={onReset}>Reset</Button>
</>
```

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Modifying the DOM

- **DOM – an internal data structure representing the browser's current 'display area' ; DOM always** in sync **with the display.**

- **Traditional performance best practice:**
  1. **Minimize direct accessing of the DOM.**
  2. **Avoid 'expensive' DOM operations.**
  3. **Update elements offline, then replace in the DOM.**
  4. **Avoid changing layouts in Javascript.**
  5. **. . . etc.**

- **Should the developer be responsible for low-level DOM optimization? Probably not.**
  - **React provides a *Virtual DOM* to shield developers from these concerns.**

The Virtual DOM

- **How React works:**
  1. **At app startup it create a lightweight, efficient form of the DOM, termed the *Virtual DOM*.**
  2. **The app changes the V. DOM whenever a component re-renders.**
  3. **When the re-rendering cycle is complete, the React engine:**
     1. **Performs a *diff* operation between the current and previous V. DOM instance.**
     2. **Computes the *set of changes* to apply to real DOM.**
     3. **Batch update the real DOM.**

- **Benefits:**
  a) **Cleaner, more descriptive programming model.**
  b) **Optimized DOM updates and reflows.**

Automatic Re-rendering (detail)

- **EX.: The Counter component.**

User clicks button

→ *onClick event handler executed*

→ *component state is changed*

→ *component re-executed (re-renders)*

→ *The Virtual DOM has changed*

→ *React diffs the changes between the current and previous Virtual DOM*

→ *React batch updates the Real DOM*

Re-rendering & the real DOM

- **What happens when the user types in the text box?**

User types a character in text box

→ *onChange* ***event handler executes***

→ ***Handler changes a state variable***

→ ***React re-renders*** *FriendsApp component*

→ ***React re-renders children (****FilteredFriendList****) with new prop values.***

→ ***React re-renders children of*** *FilteredFriendList****.***

(Re-rendering completed)

→ ***(Pre-commit phase) React computes the updates required to the browser's DOM***

→ ***(Commit phase) React batch updates the DOM.***

→ ***Browser repaints screen***

Summary

- **A state variable change always causes a component to re-render.**
  - **State change logic is usually part of an event handler function.**
  - **Event hadler may be in a subordinate component.**

- **Side effects:**
  - **Always execute at mount time.**
  - **The dependency array will either reference a state variable, a value computed from a state variable, or a prop.**
    - **Can be multiple entries**
  - **Callback performs the side-effect, and may also cause a state change.**

- **Data flows downward, actions flow upward.**