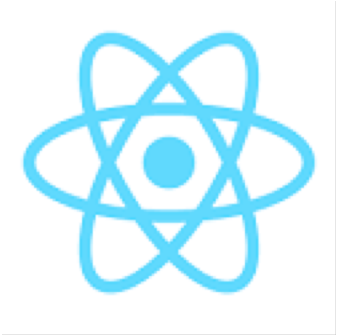


ReactJS.

The Component model

Topics

- **Component State.**
  - **Basis for dynamic, interactive UI.**
- **The Virtual DOM.**
- **Data Flow patterns.**
- **Lifecycle methods.**

Component DATA

- **Two sources of data for a component:**
  1. **Props - Passed in to a component; Immutable; an object (t**his.props**).**
  2. *State* **- Managed internally by the component; Mutable; an object (**this.state**)**
     - ***** The basis for dynamic and interactive Uis *****

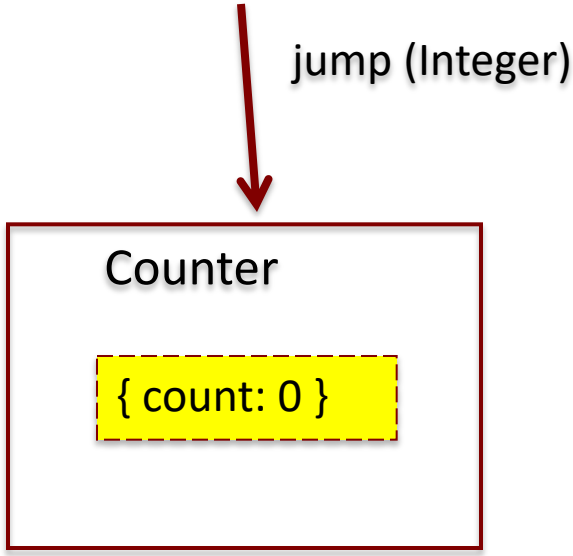
- **Props-related features:**
  - **Default values.**
  - **Type-checking.**

- **State-related features:**
  - **Initialization.**
  - **Mutation - the** setState() **method.**
    - **Performs a merge operation, not an overwrite.**
    - ***** Automatically causes component to re-render. *****

Component Data- Example

- **The Counter component.**
- **Ref.** samples/06_state.js

- **Coding features:**
  1. **Custom function/method, e.g.** incrementCount**().**
  2. **Static class property, e.g.** defaultProps**.**
  3. **Class instance property, e,g.** state**.**



React's event system.

- **Cross-browser support.**
- **Event handlers receive** SyntheticEvent **– a cross-browser wrapper for the browser's native event.**
- **React event naming convention slightly different from native:**

React	Native
onClick	onclick
onChange	onchange
onSubmit	onsubmit

- See https://reactjs.org/docs/events.html for full details,

Automatic Re-rendering

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

User clicks ‘increment’ button

→ onClick event handler (incrementCounter) executed

→ state is changed (setState())

→ render() method executed

Modifying the DOM

- **DOM – an internal data structure; mirrors the state of the UI; always in sync.**
- **Traditional performance best practice:**
  1. **Minimize access to the DOM.**
  2. **Avoid expensive DOM operations.**
  3. **Update elements offline, then reinsert into 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 developer from these concerns.**

The Virtual DOM

- **How?**
  1. **Create a lightweight, efficient form of the DOM – the Virtual DOM.**
  2. **React app changes V DOM**
  3. **React engine:**
     1. **Perform *diff* operation between current and previous V DOM state.**
     2. **Compute the minimal set of changes to apply to (real) DOM.**
     3. **Batch execute all updates to real DOM.**

- **Benefits:**
  a) **Clean – Clean, descriptive programming model.**
  b) **Fast - Optimized DOM updates and reflows.**

Automatic Re-rendering (detail)

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

User clicks 'increment' button

→ *onClick event handler (incrementCounter) executed*

→ *state is changed (setState())*

→ *render() method executed*

→ *The Virtual DOM has changed*

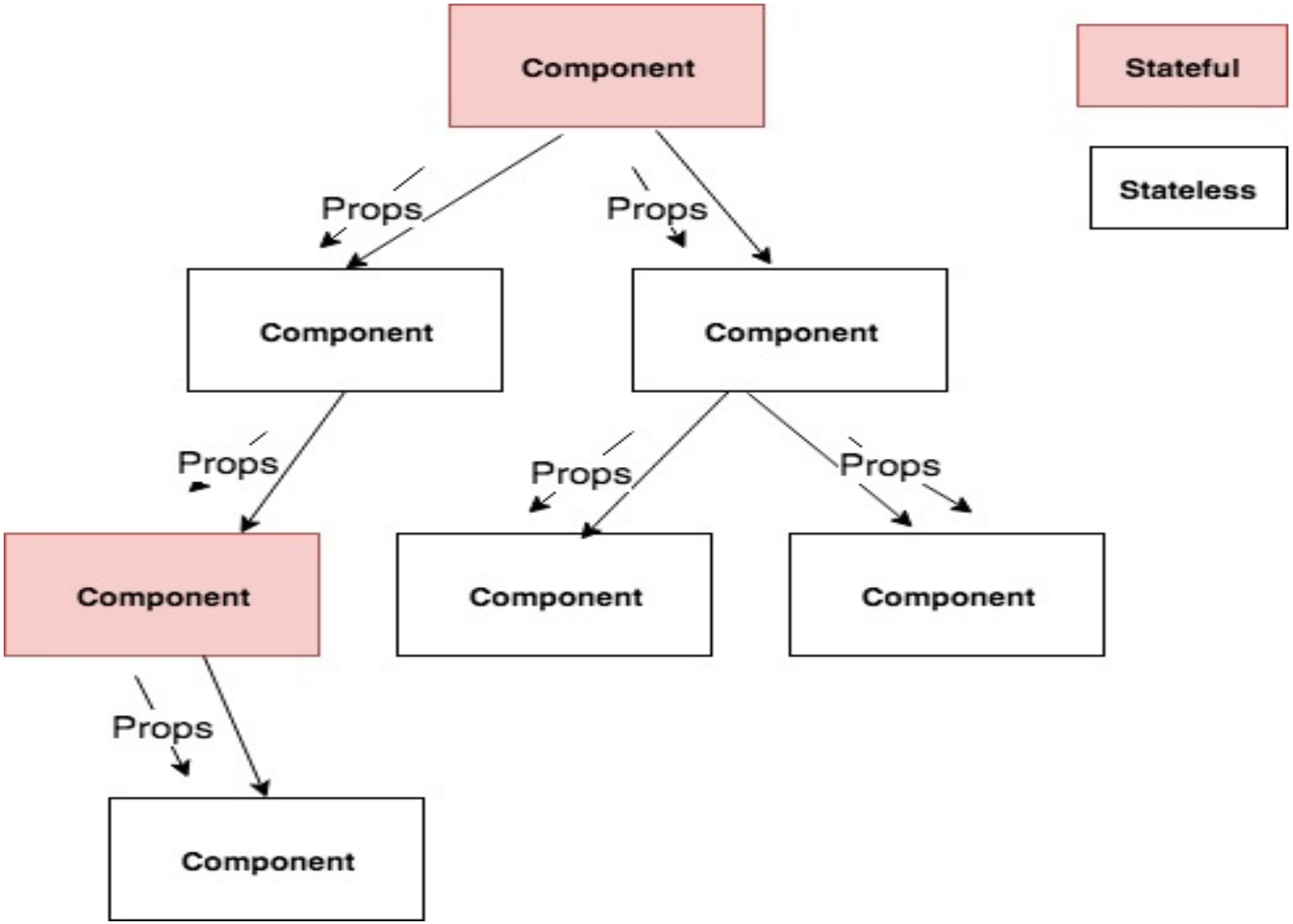
→ *React diffs the changes (between the current and previous Virtual DOM)*

→ *React batch updates the Real DOM*

Topics

- **Component State.** ✔
- **The Virtual DOM.** ✔
- **Data Flow patterns.**
- **Lifecycle methods.**

Unidirectional data flow



Unidirectional data flow

- **In a React app, data flows uni-directionally ONLY.**
  - **Most other SPA frameworks use two-way data binding.**

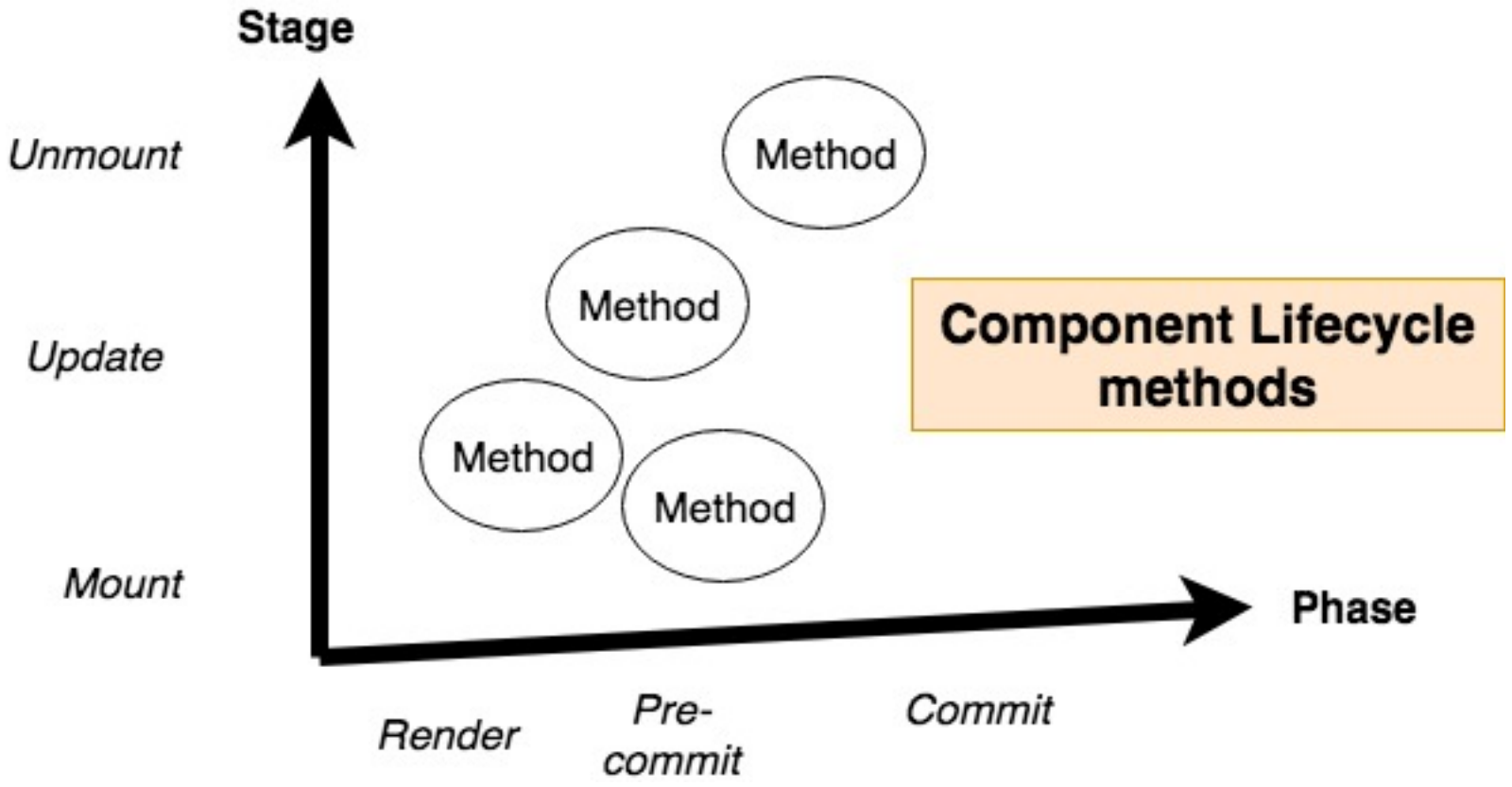
- **In a multi-component app, a common pattern is:**
  - **A small subset (maybe only 1) of components will be statefull – the rest are stateless.**

- **Statefull components:**
  - **Call *setState*() to update its state.**
  - **Re-renders itself.**
  - **Pass updated props to subordinate components.**
  - *React guarantees subordinate components are re-rendered with updated (perhaps unchanged!!) props.*

Topics

- **Component State.** ✔
- **The Virtual DOM.** ✔
- **Data Flow patterns.** ✔
- **Lifecycle methods.**

Component *Lifecycle methods*



Component *Lifecycle methods*

- **Methods invoked by React at specific times in a component's lifecycle (Most are optional).**

- **Lifecycle stages:**
  1. **Mounting (Initialization).**
  2. **Update.**
     a) **New props (even when value is unchanged!!).**
     b) **setState();.**
     c) **forceUpdate.**
  3. **Un-mounting.**

- **Phases:**
  - **Render phase.**
  - **Pre-commit phase (Pre DOM update).**
  - **Commit phase (Post DOM update).**

The Lifecycle methods

1. shouldComponentUpdate**() – returns boolean – can cause a component to skip re-rendering.**

2. getDerivedStateFromProps**() - when a component state object is computed from its prop values.**

3. componentDidUpdate**() – executed after a rendering has updated the real DOM, e.g. perform real DOM manipulation, set up external subscription, cause side-effect.**

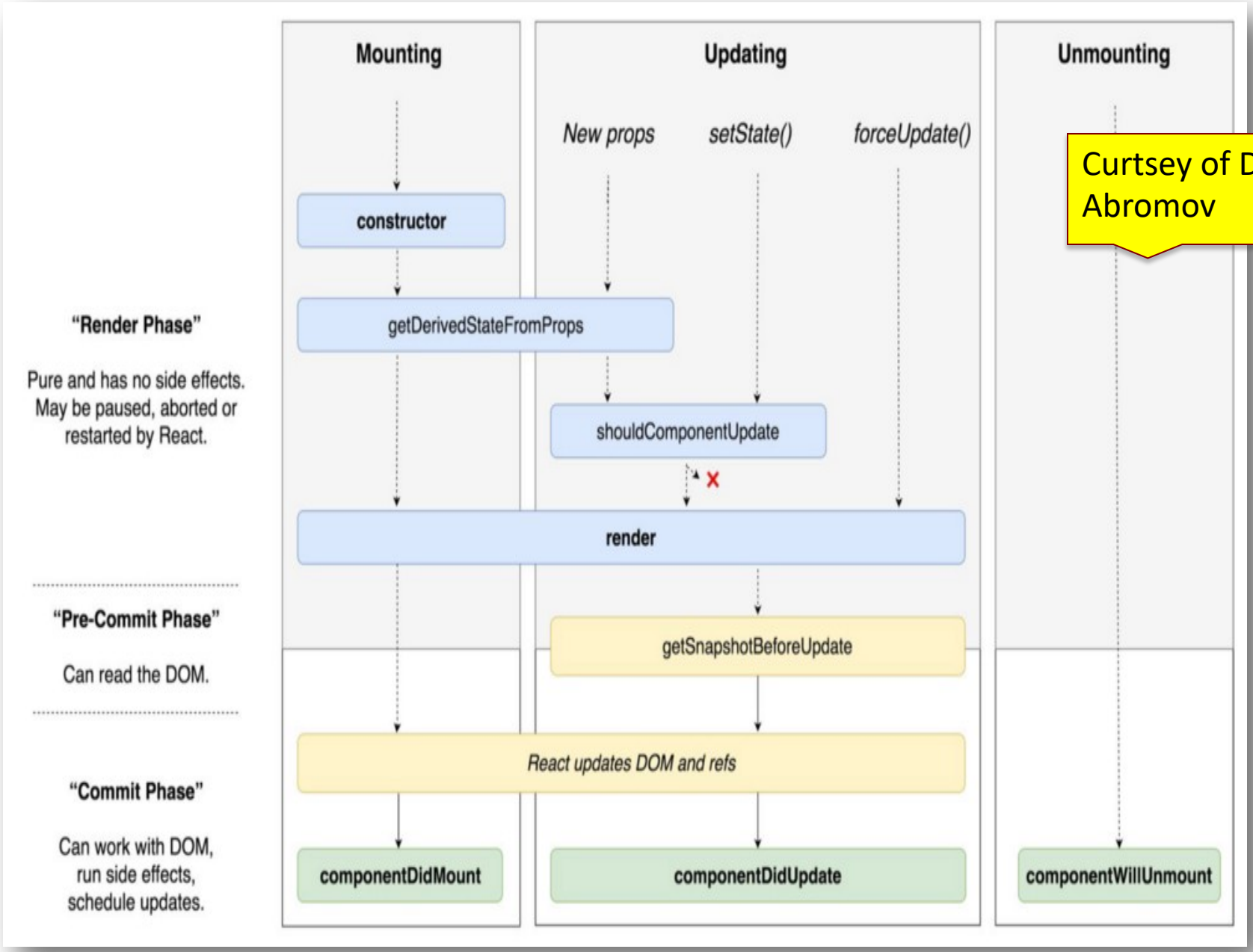
4. componentDidMount**() – executed after component has mounted (see later)**

5. **componentWillUnmount(); executed before a component is about to unmount; Perform cleanup operations, e.g. remove external subscription.**

The Lifecycle methods

- *shouldComponentUpdate()* ✡✡✡
- *getDerivedStateFromProps().*
- *render().* ✡✡✡
- *componentDidUpdate()*
- *componentDidMount()* ✡✡✡
- *componentWillUnmount***()**

✡✡✡ used most frequently



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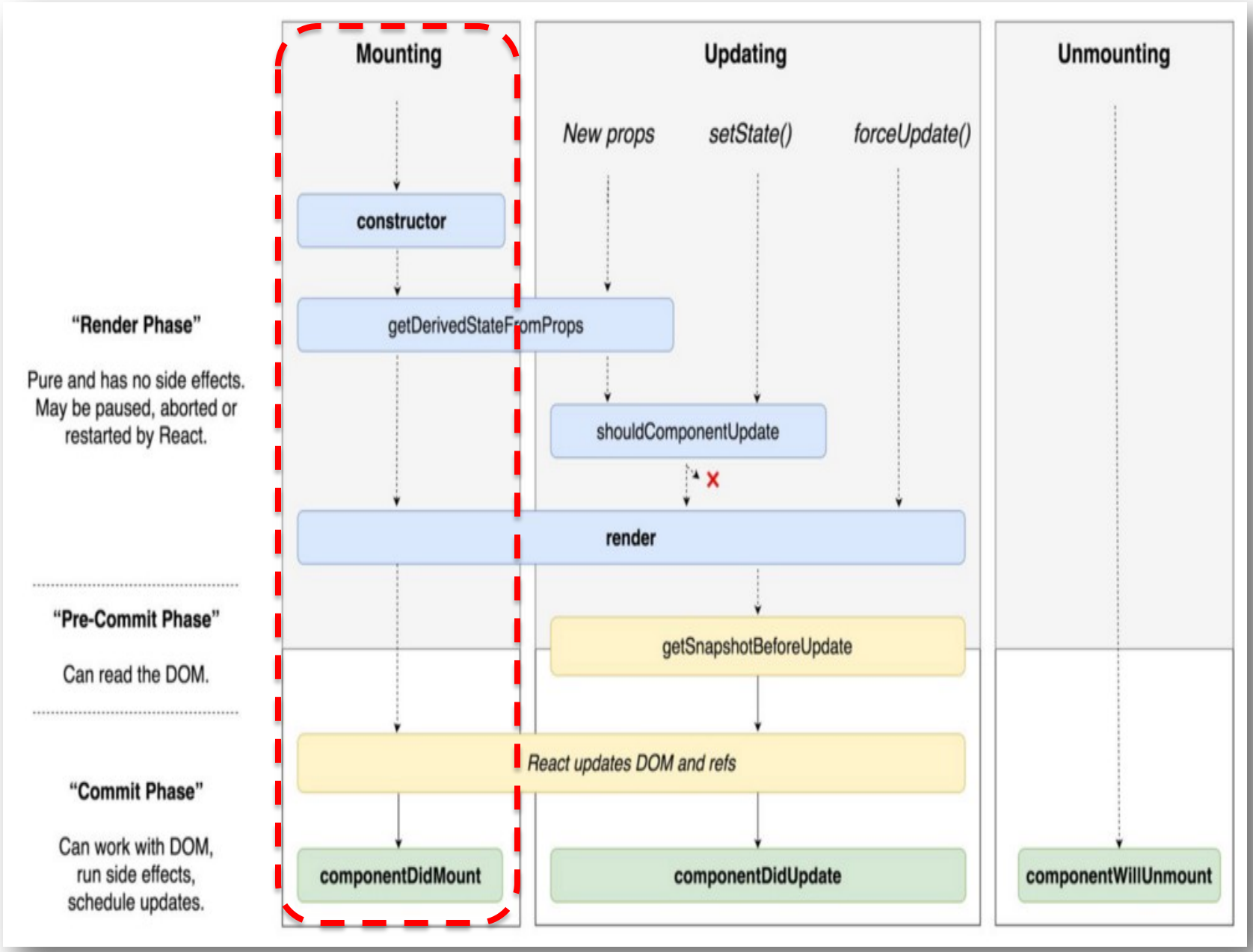
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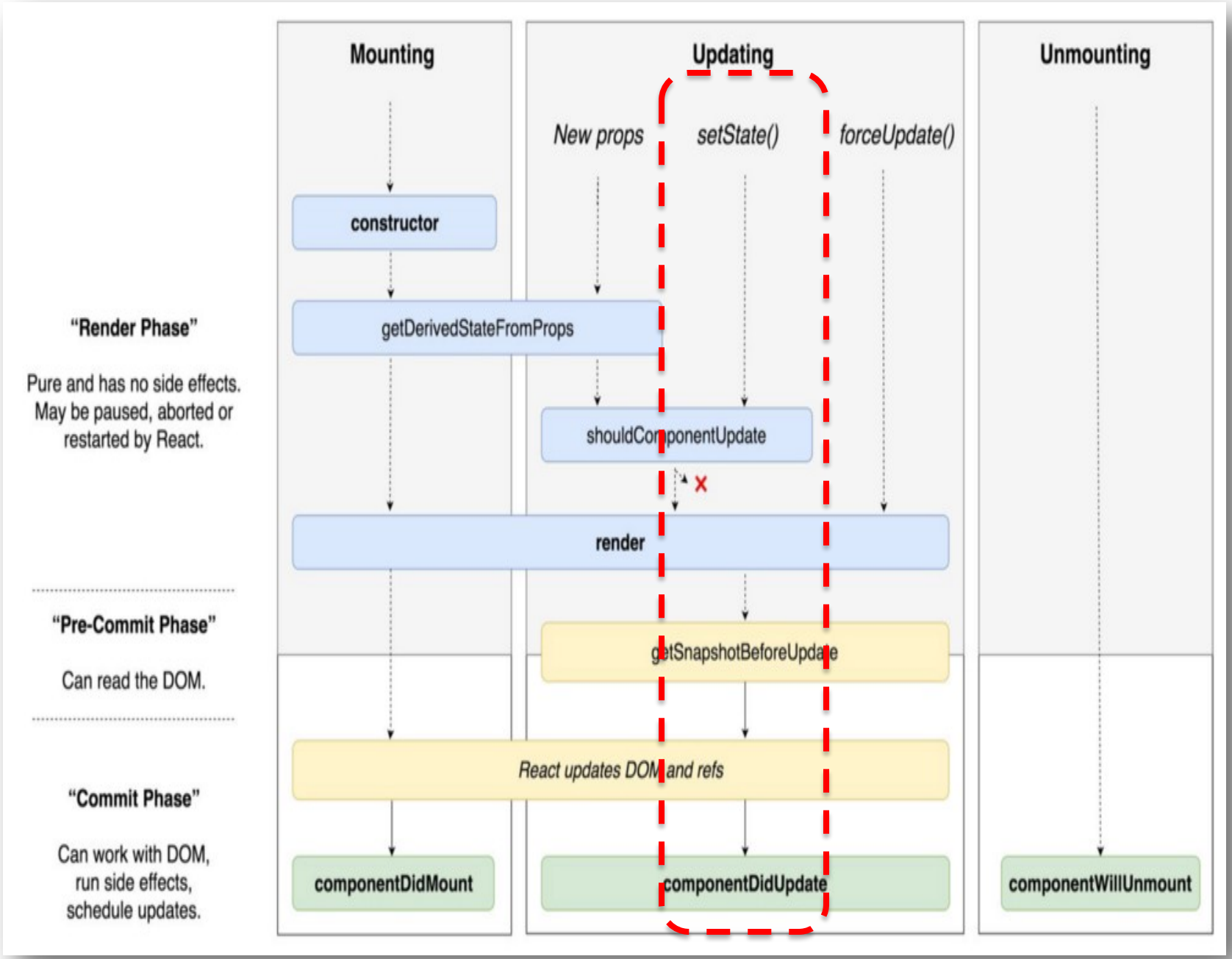
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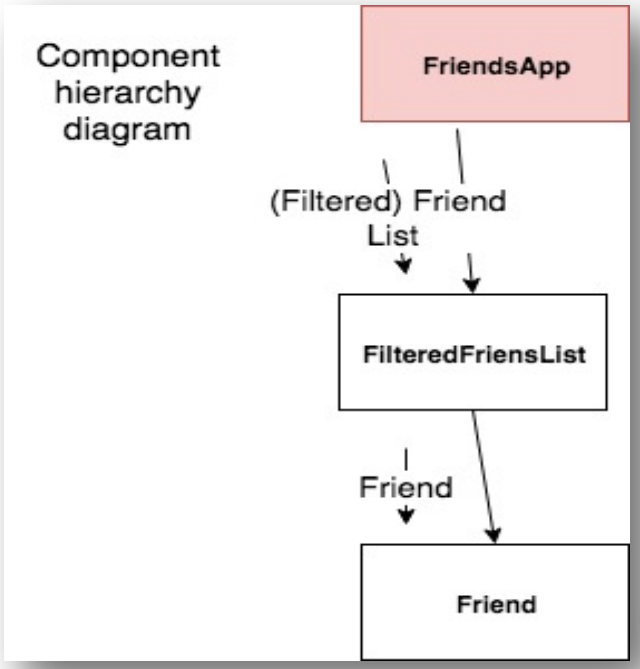
Sample App



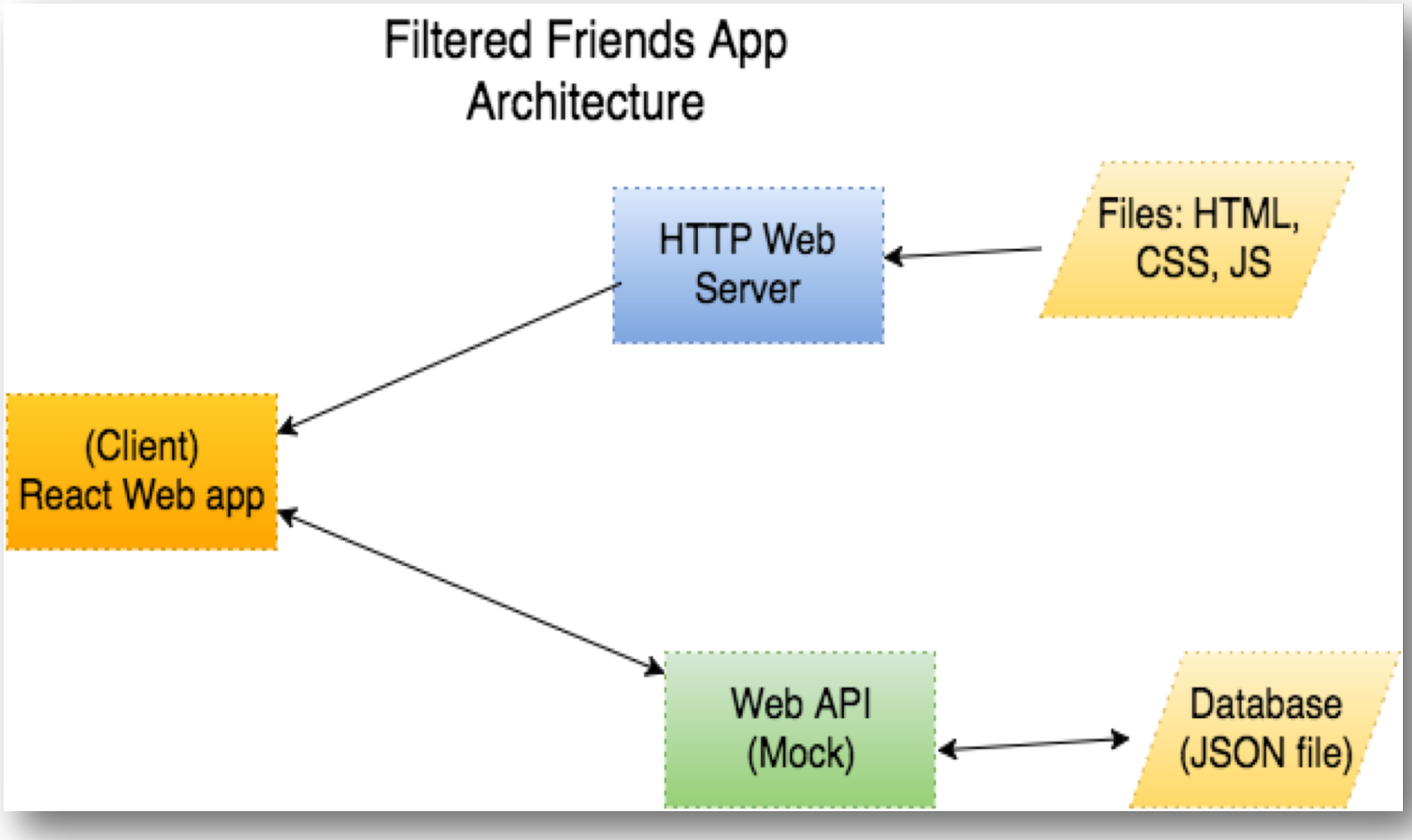
***FriendsApp* component:**

1.Manages app's state (i.e. text box content).

2.Computes matching friends list.

3.Controls list re-rendering.

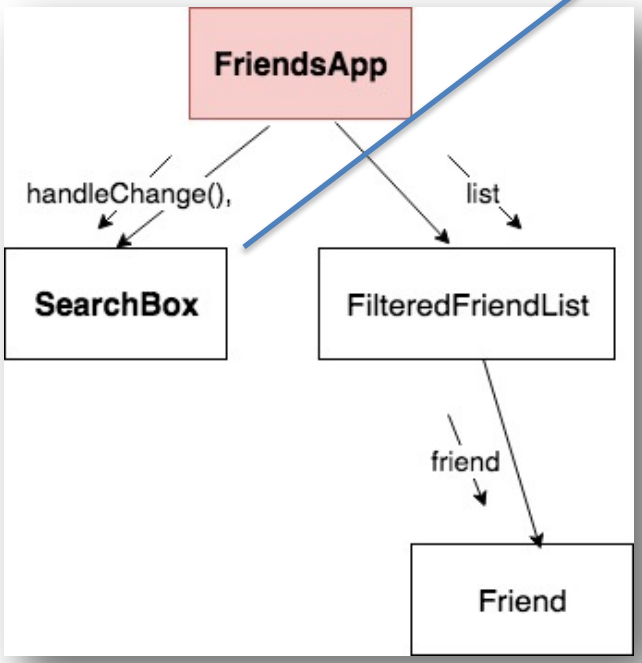
Sample App – Architecture..



DEMO

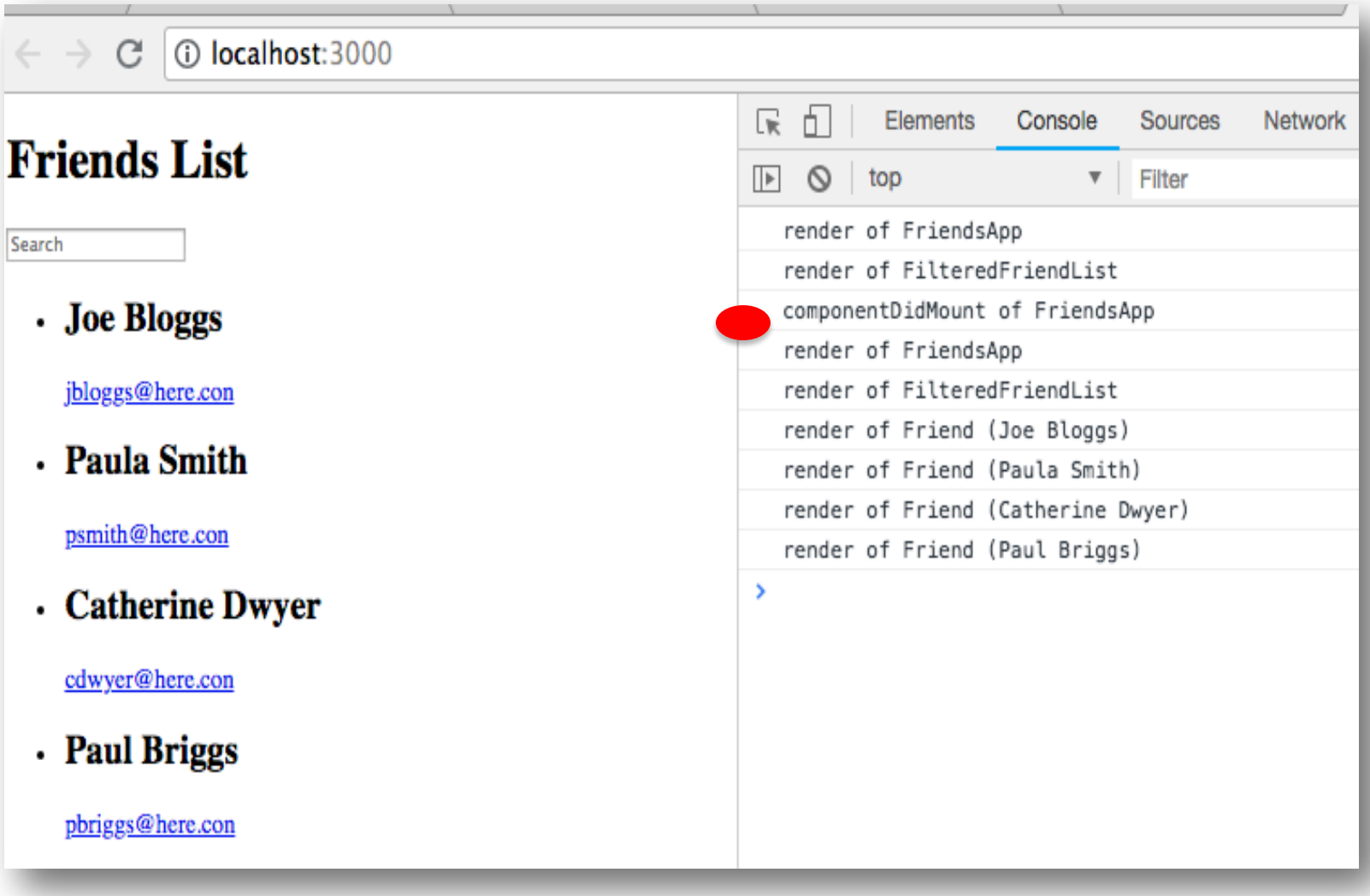
Inverse data flow

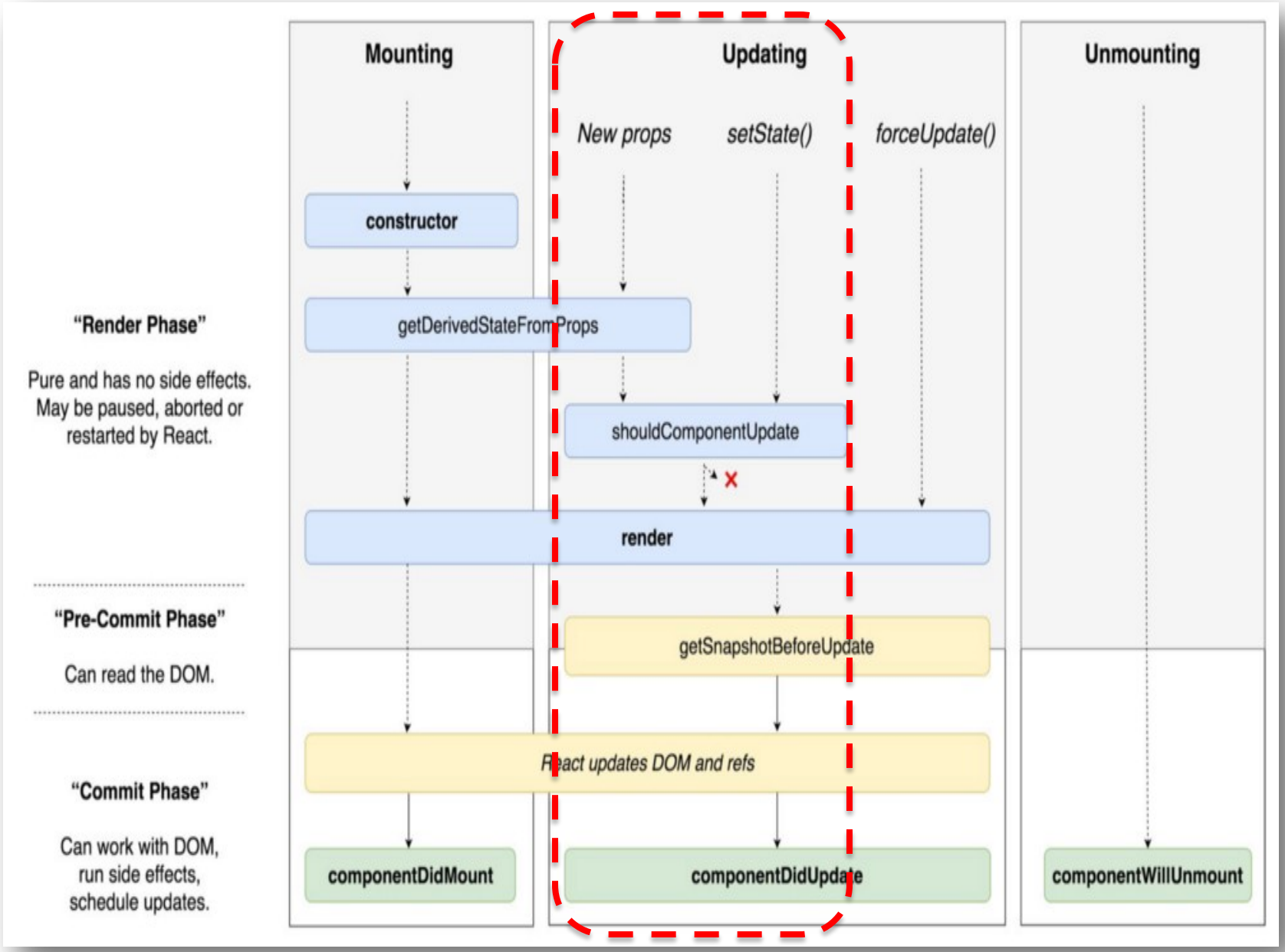
- **What if a component's state is effected by an event in a subordinate component?**
- **Solution: The** inverse data flow pattern.



. . . . . back to Lifecycle methods . . . .

Sample App – Execution trail (Mounting & setState)

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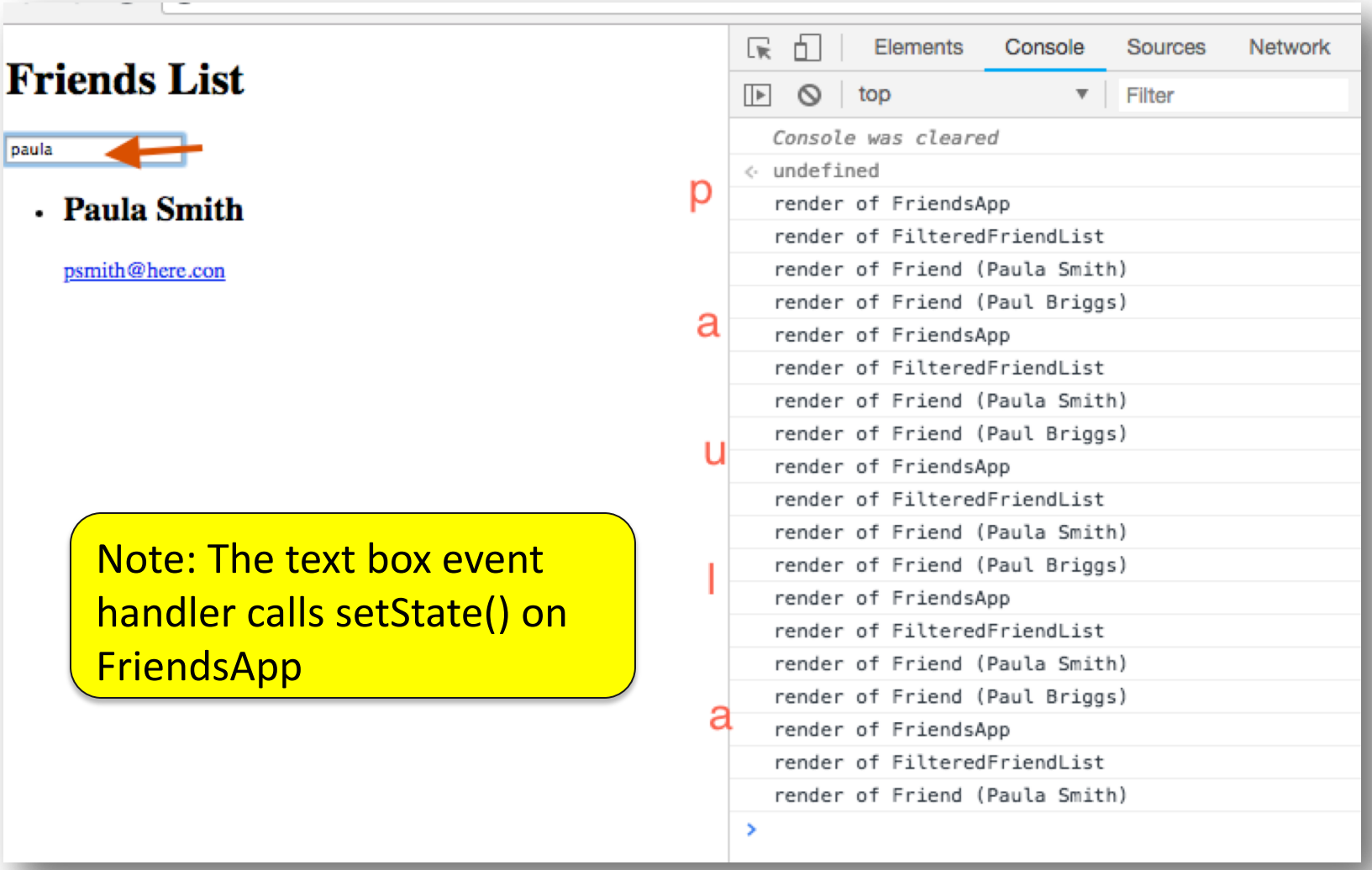
Sample App – Execution trail (Update on new props & setState)..



Unidirectional data flow & **Re-rendering**

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

  User types a character in text box

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

  → ***Handler calls setState() (****FriendsApp* ***component)***

  → ***React calls*** *FriendsApp* ***render() method***

  → ***React calls render() method of children (****FilteredFriendList****) with new prop values***

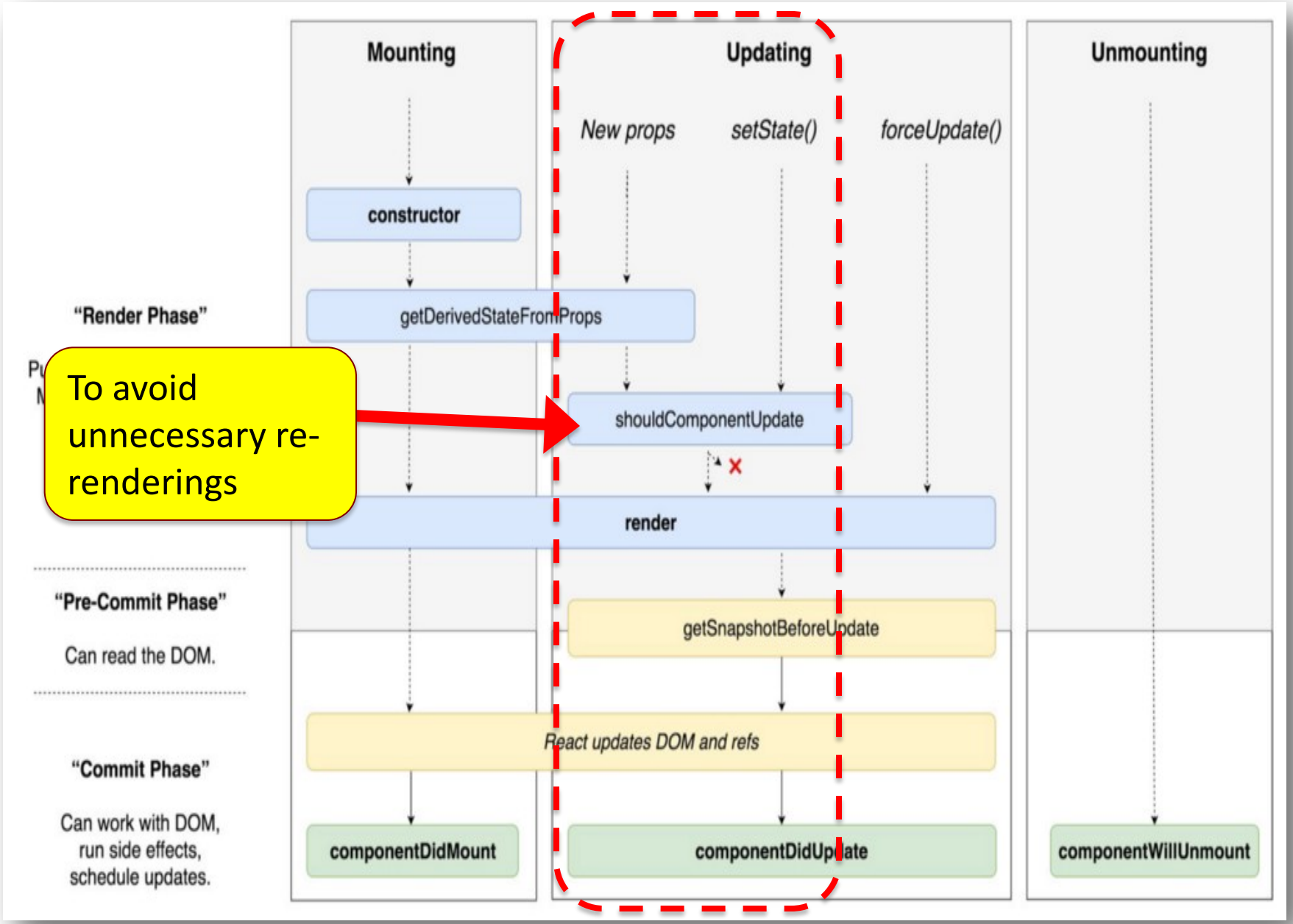
  → ***React calls render() method of children of*** *FilteredFriendList****.***

  → ***(Pre-commit phase) React re-computes the new Virtual DOM***

  → ***React diffs the new and previous Virtual DOMs***

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

  → ***Browser repaints screen***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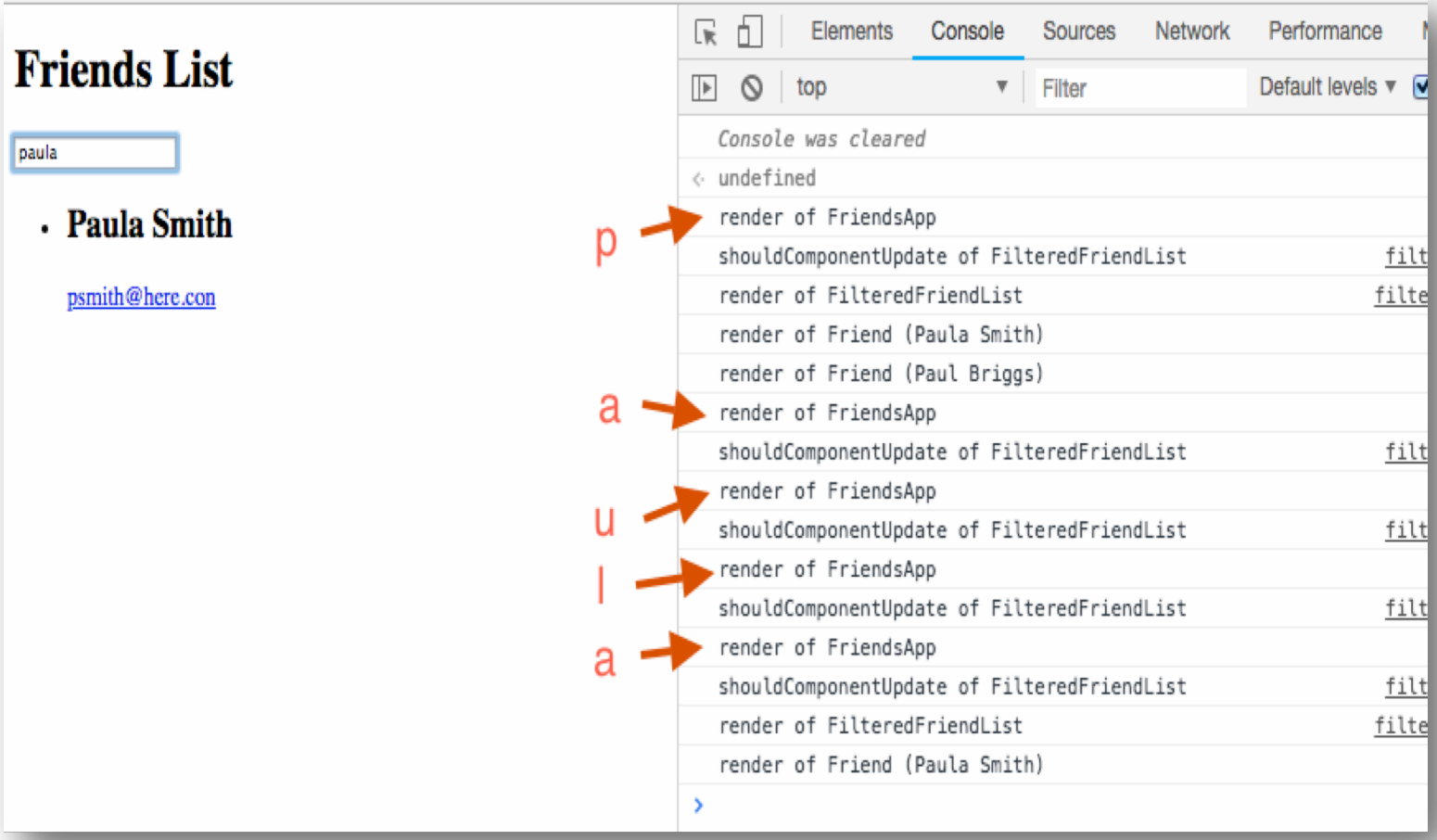
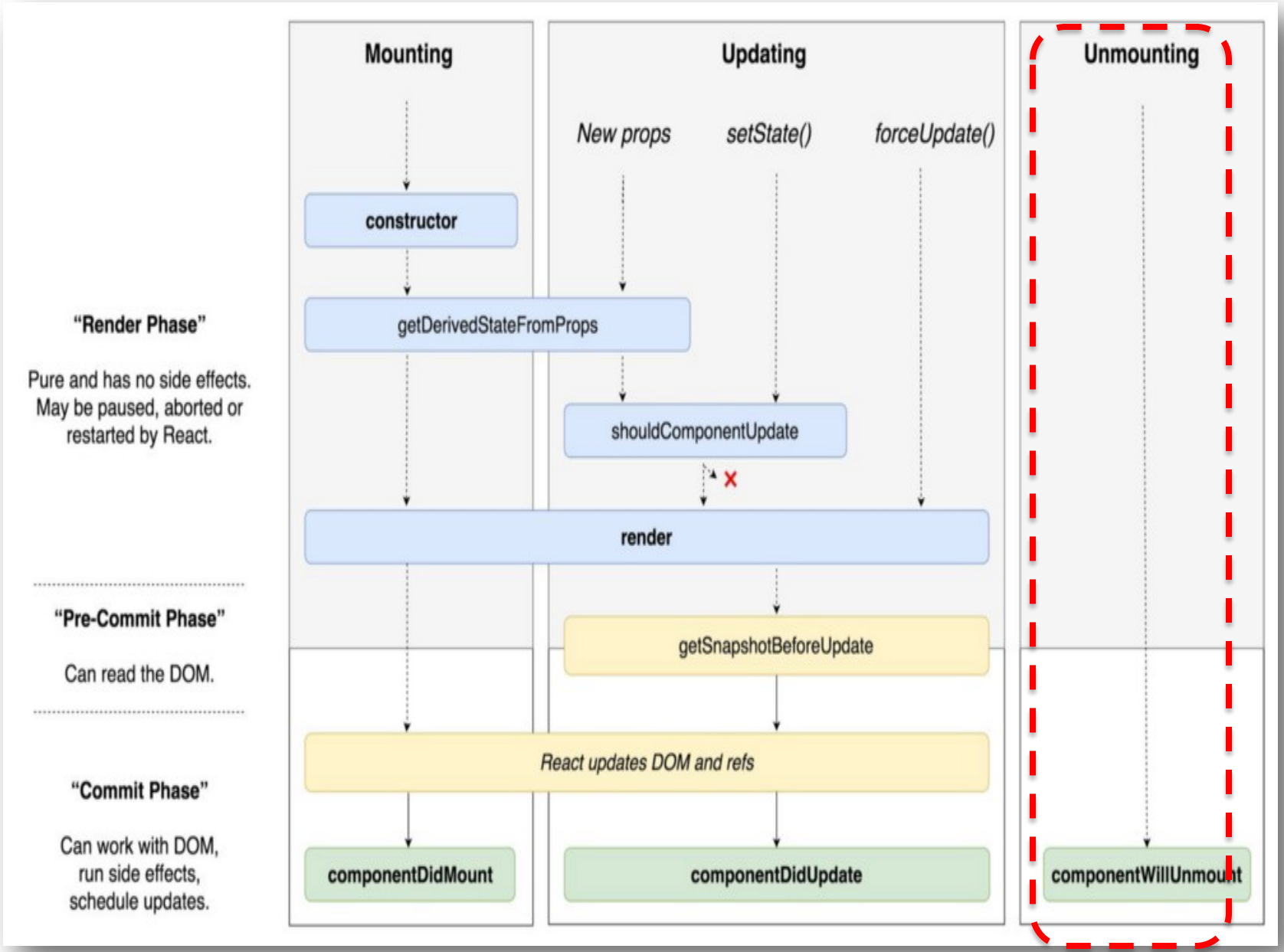
Sample App – Execution trail (Update on new props & setState)..

FilteredFriendsList should NOT re-render if the length of the array of matching friends (its prop) has not changed.

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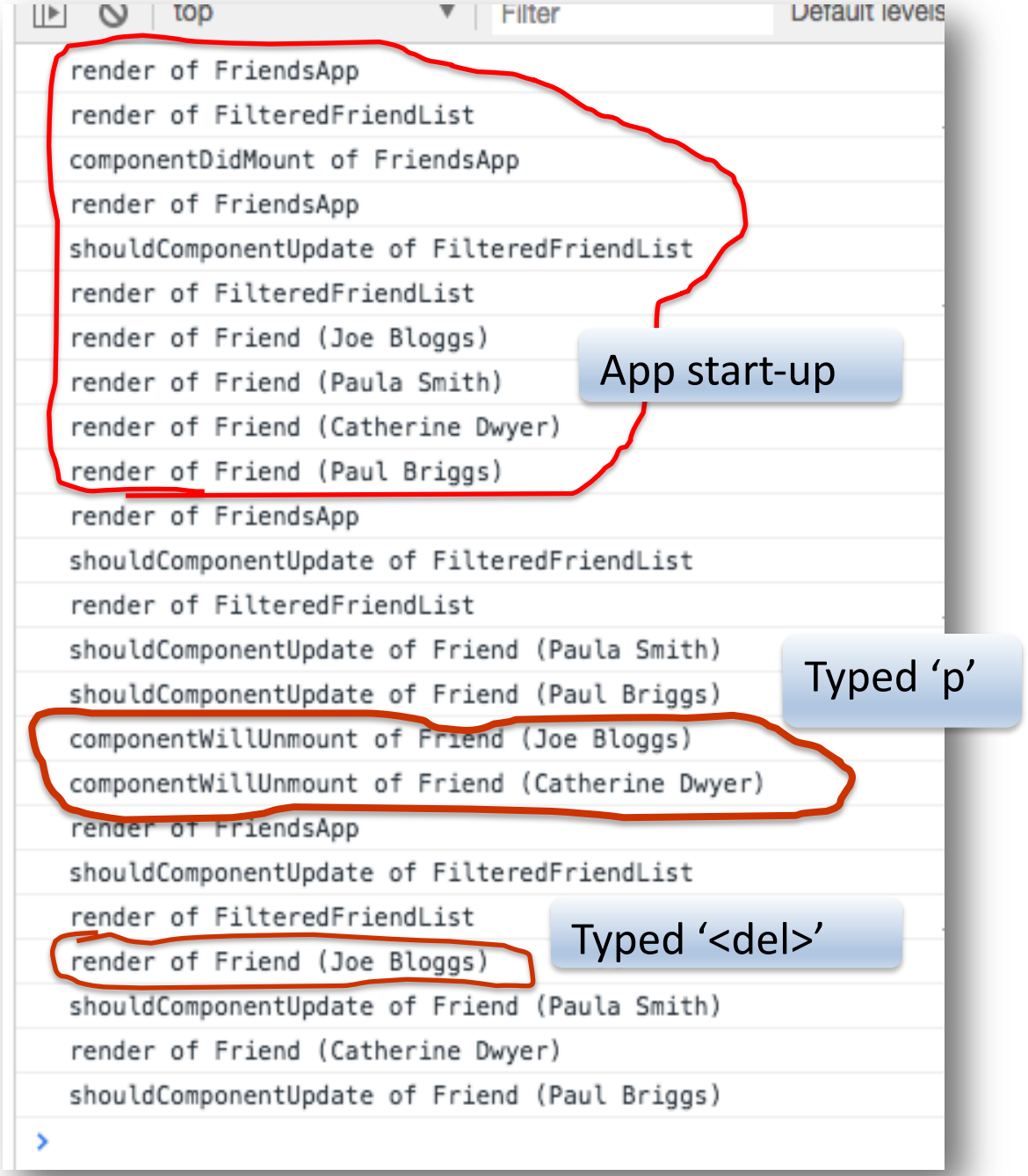
Sample App – Execution trail (Un-mounting)..



Summary

- **For interactive apps we record the user's input/interaction in component(s) state object.**
  - **The interaction may cause UI changes – dynamic app.**

- **React achieves DOM update performance improvements by managing an intermediate data structure, the Virtual DOM.**

- **Data only flows downward through the component hierarchy – this aids debugging.**

- **A component's life-span includes stages, from** mounting **to** un-mounting, **and phases, including** render, pre-commit and post-commit**.**
  - **We can hook logic in to the life span at prescribed times using lifecycle methods.**