5 React Optimization Techniques

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5 Techniques:

1. List Visualization
2. Lazy Loading
3. Memoization
4. Throttling and Debouncing events
5. Use Transition Hook

List Visualization:

What is it? Efficiently render large lists using tools like React's Virtualized List.

Why it's needed:

- Avoid slow performance on lists with thousands of items
- Only render visible items

Real-life example: Imagine a social media feed showing thousands of posts. With list optimizations, only visible posts are rendered, improving scroll performance.

- Prevents lag from large lists
- Only renders visible items
- Reduces memory and CPU usage

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Code Example:

```
import React from "react";
import { List } from "react-virtualized";
import "react-virtualized/styles.css";

// Your list data
const list = Array(20000)
 .fill()
 .map((_, index) => ({
  id: index,
  name: `Item ${index}`,
 }));

// Function to render each row
function rowRenderer({ index, key, style }) {
 return (
  <div key={key} style={style}>
   {list[index].name}
  </div>
 );
}
```

```
// Main component
function ListOptimization() {
 return (
  // Fast and efficient way
  <List
   width={300}
   height={300}
   rowCount={list.length}
   rowHeight={20}
   rowRenderer={rowRenderer}
  />

  // Normal Way (take time to load)
  // <>
  //   <ul>
  //     {list.map((li) => (
  //       <li>{li.name}</li>
  //     ))}
  //   </ul>
  // </>
 );
}

export default ListOptimization;
```

Lazy Loading:

What is it? Load components or resources only when needed, instead of all at once.

Why it's needed:

- Improve initial load time
- Reduce unnecessary downloads

Real-life example: Think of a long e-commerce page. Instead of loading all product pages upfront, only load pages when the user visits them.

- Reduces app size at startup
- Optimizes performance for large apps
- Especially useful for routes or images

Code Example:

```
import React, { lazy, Suspense } from "react";
import { BrowserRouter, Link,
Route, Routes } from "react-router-dom";

const Admin = lazy(() => import("./Admin"));

const LazyLoadingExample = () => {
 return (
  <BrowserRouter>
   <h1>Home Page</h1>
   <Link to={"/admin"}>Admin</Link>
   <Routes>
    <Route
     path="/admin"
     element={
      <Suspense>
       <Admin />
      </Suspense>
     }
    />
   </Routes>
  </BrowserRouter>
 );
};

export default LazyLoadingExample;
```

```
// Admin.js

import React from "react";
const Admin = () => {
 return (
  <div>
   <h1>Admin Page</h1>
   <p>Lorem ipsum*5000000....
   </p>
  </div>
  )
}

export default Admin;
```

Memoization:

What is it? Memoizes a computed value, recalculating only when dependencies change.

Why it's needed:

- Avoids unnecessary recalculations
- Boosts performance in components with expensive calculations

Real-life example: In a dashboard showing analytics, useMemo can cache expensive calculations like data summaries.

- Avoids re-rendering large components
- Reduces computation time
- Useful for data-heavy components

Code Example:

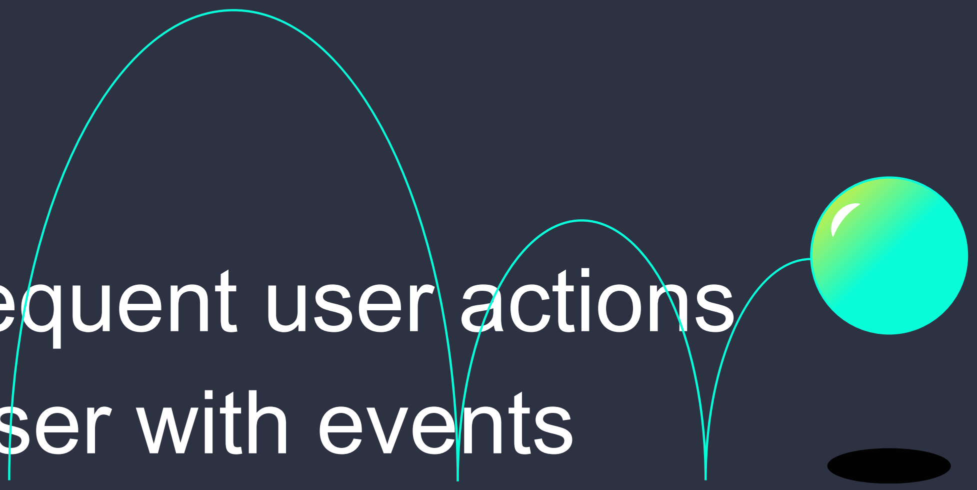
```
import React, { useMemo } from "react";

const MemoizedExample = () => {
 const [count, setCount] = React.useState(0);
 const [otherState, setOtherState] = React.useState("");

 const expensiveComputation = (num) => {
  let i = 0;
  while (i < 1000000000) i++;
  return num * num;
 };

  const memoizedValue = useMemo(() => expensiveComputation(count), [count]); // With Memo (Fast)
 //   const memoizedValue = expensiveComputation(count); // Without Memo (Time taking)

 return (
  <div>
   <p>Count: {count}</p>
   <p>Square: {memoizedValue}</p>
   <button onClick={() => setCount(count + 1)}>Increase Count</button>
   <input
    type="text"
    onChange={(e) => setOtherState(e.target.value)}
    placeholder="Type something to check rerendering"
    style={{ width: "100%" }}
   />
  </div>
 );
};

export default MemoizedExample;
```

Throttling & Debouncing:

What is it? Limits the rate at which a function is invoked (throttling) or ensures a function runs only after it hasn’t been called for a specified time (debouncing).

Why it's needed:

- Improves performance for frequent user actions
- Avoids overloading the browser with events



Real-life example: Imagine resizing a window or typing in a search bar. Throttling ensures the resize event doesn't fire continuously. Debouncing waits for the user to stop typing before making a search request.

- Reduces the number of API calls
- Prevents performance degradation
- Ideal for scroll, resize, or input events

Code Example:

```
// Throttling.js
import React, { useState, useEffect } from "react";

const Throttling = () => {
 const [scrollPosition, setScrollPosition] = useState(0);

  const handleScroll = () => {
      setScrollPosition(window.scrollY);
  }; // Throttled to run once every 1 second

  const throttle = (func, delay) => {
    let lastCall = 0;
    return function (...args) {
      const now = new Date().getTime();
      if (now - lastCall < delay) {
        return;
      }
      lastCall = now;
      func(...args);
    };
  };

  useEffect(() => {
                                  window.addEventListener("scroll",
throttle(handleScroll, 1000));
    return () => {
                              window.removeEventListener("scroll",
throttle(handleScroll, 1000));
    };
  }, []);

  return (
    <div>
      <h1>Scroll position: {scrollPosition}</h1>
      <div style={{ height: "200vh" }}>
        Scroll down to see throttling in action!
      </div>
    </div>
  );
};

export default Throttling;
```

Code Example:

```
// Debouncing.js
import React, { useState, useCallback } from "react";
import { debounce } from "lodash";

const Debouncing = () => {
  const [searchTerm, setSearchTerm] = useState("");
  const [displayTerm, setDisplayTerm] = useState("");

  const handleSearch = useCallback(
    debounce((term) => {
      setDisplayTerm(term);
    }, 500), // Debounced to execute 500ms after the user stops typing
    []
  );

  const handleChange = (e) => {
    const term = e.target.value;
    setSearchTerm(term);
    handleSearch(term);
  };

  return (
    <div>
      <input
        type="text"
        value={searchTerm}
        onChange={handleChange}
        placeholder="Type to search"
      />
      <p>Search results for: {displayTerm}</p>
    </div>
  );
};

export default Debouncing;
```

useTransition()

What is it? Delays non-urgent updates to maintain smooth UI transitions.

Why it's needed:

- Prevents janky UI when multiple state updates occur
- Useful in apps with heavy state changes

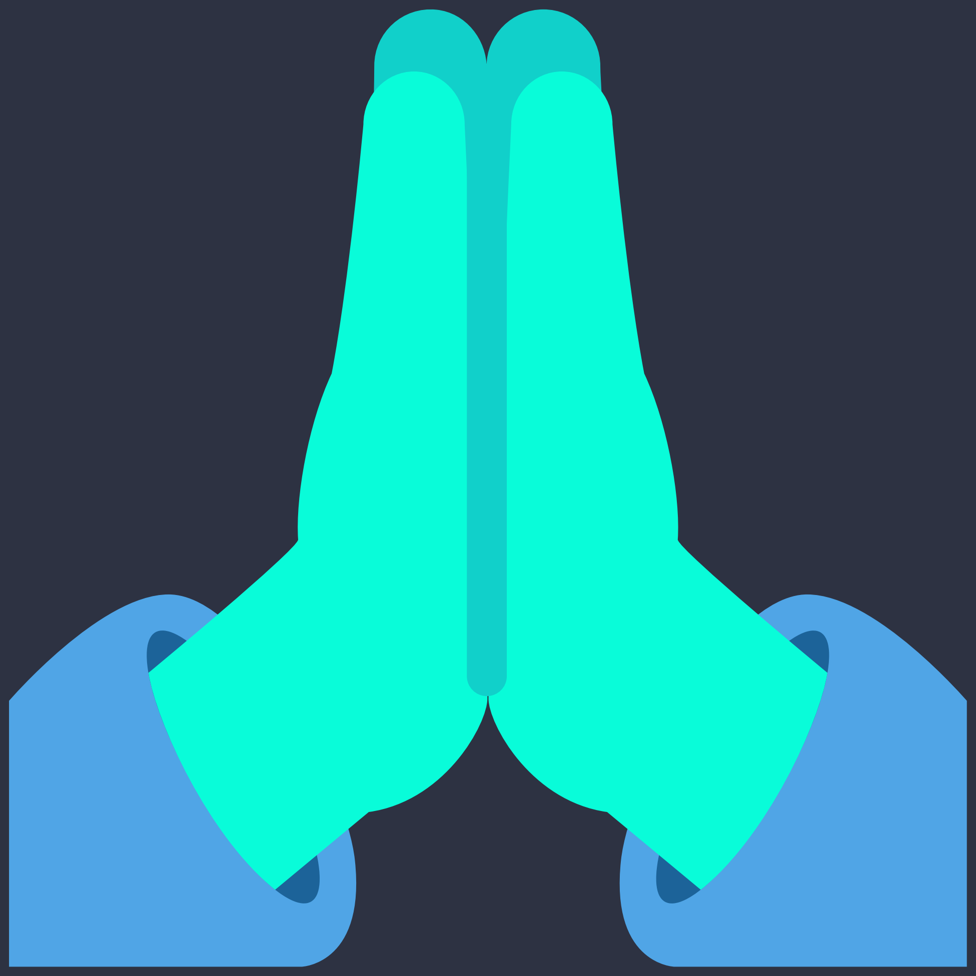
Real-life example: Imagine typing in a search box that filters a list. With useTransition, the input remains responsive while filtering happens in the background.

- Keeps the UI responsive
- Prioritizes important state updates
- Ideal for input-heavy forms or searches

Code Example:

```
const UseTransition = () => {
  const [search, setSearch] = useState("");
  const [filteredUsers, setFilteredUsers] = useState(users);
  const [isPending, startTransition] = useTransition();

  const handleChange = (e) => {
    setSearch(e.target.value);
    startTransition(() =>
      setFilteredUsers(users.filter((user) => user.includes(e.target.value)))
    );
  };
  return (
    <>
      <label>Input: </label>
      <input onChange={handleChange} />
      {isPending && <p>Loading...</p>}
      {!isPending && filteredUsers.map((e) => <p>{e}</p>)}
    </>
  );
};

export default UseTransition;
```

Thanks Guys :)



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