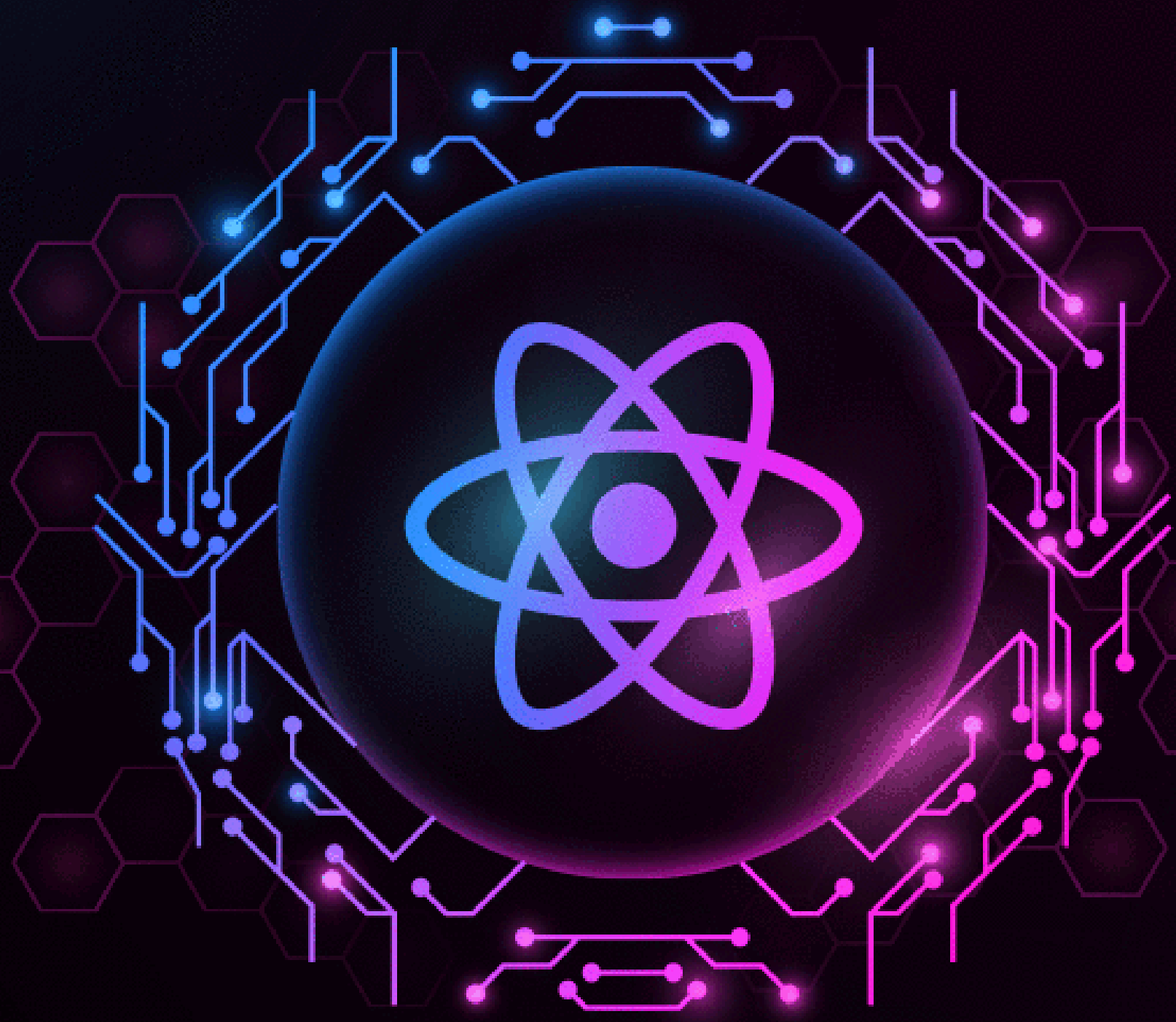


12 Key Techniques for Optimizing Your React Application

Image Optimization

Explanation: Optimizing images can significantly reduce the load time of your application.

Implementation:

- Use modern image formats (e.g., WebP) and tools for compressing images.
- Serve appropriately sized images based on the user's device.

```
<Image
src="path/to/image.webp"
loader={<img src="path/to/placeholder.jpg" />}
alt="description"
/>
```

Route-Based Lazy Loading

Explanation: Load routes and their associated components only when they are needed, reducing the initial load time.

Implementation:

- Use React Router's lazy and Suspense for route-based code splitting.

```
import React, { Suspense, lazy } from 'react';
import { BrowserRouter as Router, Route, Switch } from 'react-router-dom';

const Home = lazy(() => import('./Home'));
const About = lazy(() => import('./About'));

function App() {
  return (
    <Router>
      <Suspense fallback={<div>Loading...</div>}>
        <Switch>
          <Route path="/" exact component={Home} />
          <Route path="/about" component={About} />
        </Switch>
      </Suspense>
    </Router>
  );
}
```

Component Lazy Loading

Explanation: Load components only when they are needed to reduce the initial load time.

Implementation:

```
import React, { Suspense, lazy } from 'react';

const LazyComponent = lazy(() => import('./LazyComponent'

function App() {
  return (
    <div>
      <Suspense fallback={<div>Loading...</div>}>
        <LazyComponent />
      </Suspense>
    </div>
  );
}
```

useMemo

Explanation: Memoize expensive calculations to avoid recalculating them on every render.

Implementation:

```jsx
import React, { useMemo } from 'react';

function ExpensiveComponent({ data }) {
  const processedData = useMemo(() => {
    // expensive computation
    return processData(data);
  }, [data]);

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

React.memo

Explanation: Prevent unnecessary re-renders of functional components by memoizing them.

Implementation:

```
const MyComponent = memo(function MyComponent({ prop1, prop2 }) {
  // component logic
});
```

useCallback

Explanation: Memoize functions to prevent them from being re-created on every render.

Implementation:

```jsx
import React, { useCallback } from 'react';

function MyComponent({ onClick }) {
  const handleClick = useCallback(() => {
    // handle click
  }, [onClick]);

  return <button onClick={handleClick}>Click me</button>;
}
```

useEffect Cleanup

Explanation: Clean up side effects in useEffect to avoid memory leaks and ensure proper resource management.

Implementation:

```
import React, { useEffect } from 'react';

function MyComponent() {
  useEffect(() => {
    const handleScroll = () => {
      // handle scroll
    };

    window.addEventListener('scroll', handleScroll);

    return () => {
      window.removeEventListener('scroll', handleScroll);
    };
  }, []);

  return <div>Scroll to see effect</div>;
}
```

Throttling and Debouncing

Explanation: Throttle or debounce expensive operations (e.g., API calls, event handlers) to improve performance.

Implementation:

- Use lodash's throttle and debounce functions.

```
import { throttle, debounce } from 'lodash';

const handleScroll = throttle(() => {
  // handle scroll
}, 1000);

const handleSearch = debounce((query) => {
  // handle search
}, 500);

window.addEventListener('scroll', handleScroll);
inputElement.addEventListener('input', (e) => handleSearch(e.target.value));
```

Fragments

Explanation: Use fragments to avoid unnecessary wrapper elements in the DOM, which can reduce the number of nodes and improve rendering performance.

Implementation:

```jsx
import React from 'react';

function MyComponent() {
  return (
    <>
      <div>First element</div>
      <div>Second element</div>
    </>
  );
}
```

useTransition

Explanation: Use useTransition to handle state transitions without blocking the UI, improving the perceived performance.

Implementation:

```jsx
import React, { useState, useTransition } from 'react';

function MyComponent() {
  const [isPending, startTransition] = useTransition();
  const [count, setCount] = useState(0);

  const handleClick = () => {
    startTransition(() => {
      setCount(count + 1);
    });
  };

  return (
    <div>
      <button onClick={handleClick}>Increment</button>
      {isPending ? <div>Loading...</div> : <div>Count: {count}</div>}
    </div>
  );
}
```

Web Workers

Explanation: Use web workers to offload heavy computations to a background thread, keeping the UI responsive.

Implementation:

```
// worker.js
onmessage = function(e) {
    const result = heavyComputation(e.data);
    postMessage(result);
};

// Main component
import React, { useEffect } from 'react';

function MyComponent() {
    useEffect(() => {
    const worker = new Worker('./worker.js');

    worker.postMessage('some data');

    worker.onmessage = function(e) {
        console.log('Result from worker:', e.data);
    };

    return () => {
        worker.terminate();
    };
    }, []);

    return <div>Web Workers Example</div>;
}
```

Caching with React Query

Explanation: React Query helps in fetching, caching, and synchronizing server state in your React applications, reducing network requests and improving performance.

Implementation:

```
import { persistQueryClient } from '@tanstack/react-query-persist-client'
import { createSyncStoragePersister } from '@tanstack/query-sync-storage-persister'

const queryClient = new QueryClient({
  defaultOptions: {
    queries: {
      cacheTime: 1000 * 60 * 60 * 24, // 24 hours
    },
  },
})

const localStoragePersister = createSyncStoragePersister({
  storage: window.localStorage,
})
// const sessionStoragePersister = createSyncStoragePersister({ storage: window.sessionStorage })

persistQueryClient({
  queryClient,
  persister: localStoragePersister,
})
```

Frontend Performance Cheatsheet

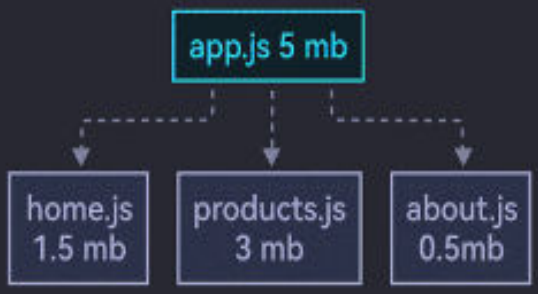
ByteByteGo

SELECTIVE RENDERING

Display only visible elements to optimize rendering performance

CODE SPLITTING

Split a bigger application bundle into multiple smaller bundles for efficient loading



COMPRESSION

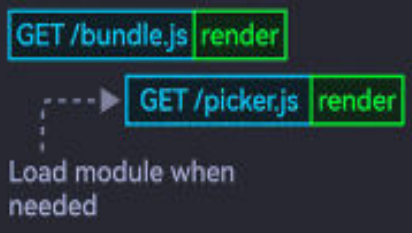
Compress files before sending them over the network

LOADING SEQUENCE

Load critical resources and above the fold content first to improve user experience

DYNAMIC IMPORTS

Load code modules dynamically based on user actions to optimize the initial loading times

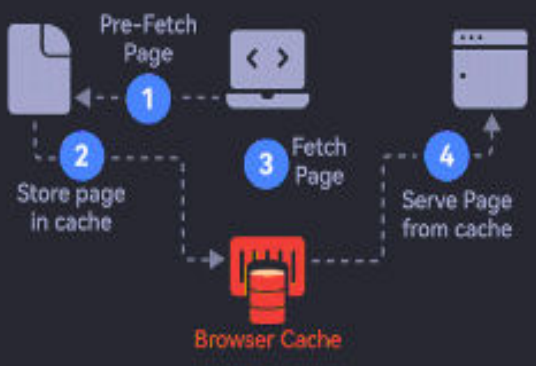


PRIORITY-BASED LOADING

Load resources that the page will need before they are needed

PRE-FETCHING

Proactively fetch or cache resources that are likely to be needed in the near future.



TREE SHAKING

Remove code that will never be used from the final JS bundle