



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Discover. Learn. Empower.

Experiment 4

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Subject Name: Full Stack

Subject Code: 23CSH-382

1. Title:

Redux Toolkit & Asynchronous State Management in EcoTrack

2. Aim:

To optimize the performance of the EcoTrack React application using memoization techniques and code splitting, and to enhance the user interface using enterprise-grade Material UI components.

3. Objective:

After completing this experiment and its follow-up tasks, the student will be able to:

1. Understand the causes of unnecessary re-renders in React applications
2. Optimize React components using `React.memo` to prevent avoidable re-renders
3. Apply `useMemo` to efficiently compute derived data and avoid redundant calculations
4. Use `useCallback` to memoize event handler functions and improve component performance
5. Implement lazy loading of components and routes using `React.lazy` and `Suspense`
6. Reduce initial bundle size and improve application load performance through code splitting

7. Enhance the visual appearance and usability of the EcoTrack application using Material UI components
8. Design a clean, consistent, and responsive user interface using Material UI layouts and typography

4. Implementation/Code:

- logSlice.jsx:

```

import { createSlice, createAsyncThunk } from "@reduxjs/toolkit";

export const fetchLogs = createAsyncThunk(
  "logs/fetchLogs",
  async() => {
    await new Promise((resolve) => setTimeout(resolve, 1000));

    return [
      { id: 1, activity: "Car Travel", carbon: 4 },
      { id: 2, activity: "Electricity Usage", carbon: 6 },
      { id: 3, activity: "Cycling", carbon: 0 },
    ]
  }
)

const logsSlice = createSlice({
  name : "logs",
  initialState : {
    data : [],
    status : "idle",
    error : null,
  },
  reducers : {},
  extraReducers : (builder) => {
    builder
      .addCase(fetchLogs.pending, (state, action) =>{
        state.status = "loading";
      })
      .addCase(fetchLogs.fulfilled, (state, action) =>{
        state.status = "success";
        state.data = action.payload;
      })
      .addCase(fetchLogs.rejected, (state, action) =>{
        state.status = "failed";
        state.error = action.error.message;
      })
  }
}

export default logsSlice.reducer;

```

- Logs.jsx:

```

import { useEffect, useMemo, useCallback } from "react";
import { useDispatch, useSelector } from "react-redux";
import { fetchLogs } from "../store/logSlice";

const Logs = () => {
  const dispatch = useDispatch();
  const { data, status, error } = useSelector((state) => state.logs);

  const handleRefresh = useCallback(() => {
    dispatch(fetchLogs());
  }, [dispatch]);

  useEffect(() => {
    if (status === "idle"){
      dispatch(fetchLogs());
    }
  }, [status, dispatch]);

  const totalCarbon = useMemo(() => {
    return data.reduce((acc, log) => acc + log.carbon, 0);
  }, [data]);

  if(status === "loading"){
    return <p>Loading Logs...</p>;
  }
  if (status === "failed"){
    return <p>Error: {error}</p>;
  }
  return (
    <div>
      <h1>Logs</h1>
      <ol>
        {data.map((log) => (
          <li key={log.id}>
            {log.activity}: {log.carbon} kg CO2
          </li>
        ))}
      </ol>
      <h3>Total Carbon: {totalCarbon} kg CO2</h3>

      <button onClick={handleRefresh}>Refresh</button>
    </div>
  );
};

export default Logs;

```

- Store.jsx:

```
import { configureStore } from "@reduxjs/toolkit";
import logsReducer from "./logSlice"

const store = configureStore({
  reducer : {
    |   logs : logsReducer,
    |
  },
});

export default store;
```

- AuthContext.jsx:

```
import { createContext, useContext, useState } from "react";

const AuthContext = createContext(null);

export const AuthProvider = ({children}) => {
  const [isAuthenticated, setIsAuthenticated] = useState(false);

  return (
    <AuthContext.Provider value = {{isAuthenticated, setIsAuthenticated}}>
      |   {children}
    </AuthContext.Provider>
  )
}

export const useAuth = () => useContext(AuthContext);
```

- ProtectedRoute.jsx:

```
import { Navigate } from "react-router-dom";
import { useAuth } from "../context/AuthContext";
import { children } from "react";

const ProtectedRoute = ({children}) => {
  const {isAuthenticated} = useAuth();

  if(!isAuthenticated) {
    |   return <Navigate to = "/login" replace/>
  }
  return children;
}

export default ProtectedRoute;
```

- Login.jsx:

```
import { useAuth } from "../context/AuthContext";
import { useNavigate } from "react-router-dom";

const Login = () => {
  const { setIsAuthenticated } = useAuth();
  const navigate = useNavigate();

  const handleLogin = () => {
    setIsAuthenticated(true);
    navigate("/");
  }

  return (
    <>
    <h3>Login</h3>
    <button onClick={handleLogin}>Login</button>
    </>
  )
}

export default Login;
```

- Logout.jsx:

```
import { useEffect } from "react";
import { useNavigate } from "react-router-dom";
import { useAuth } from "../context/AuthContext";

const Logout = () => {
  const { setIsAuthenticated } = useAuth();
  const navigate = useNavigate();

  useEffect(() => {
    setIsAuthenticated(false);
    navigate("/login");
  }, [setIsAuthenticated, navigate]);

  return <p>Logging you out...</p>;
}

export default Logout;
```

- DashboardSettings, DashboardSummary, DashboardAnalytics:

```
const DashboardSettings = () => {
  return (
    <h3>These are the settings</h3>
  )
}

export default DashboardSettings;

const DashboardSummary = () => {
  return (
    <h3>This is a Summary</h3>
  )
}

export default DashboardSummary;

const DashboardAnalytics = () => {
  return (
    <h3>This is a Analysis</h3>
  )
}

export default DashboardAnalytics;
```

- DashboardLayout.jsx:

```
import { Link, Outlet } from "react-router-dom";
import { Container, Button, Stack, Typography } from "@mui/material";

const DashboardLayout = () => {
  return [
    <Container>
      <Typography variant="h4" gutterBottom>
        Dashboard
      </Typography>

      <Stack direction="row" spacing={2} marginBottom={2}>
        <Button variant="contained" component={Link} to="settings">
          Settings
        </Button>

        <Button variant="contained" component={Link} to="summary">
          Summary
        </Button>

        <Button variant="contained" component={Link} to="analytics">
          Analytics
        </Button>
      </Stack>

      <Outlet />
    </Container>
  ];
}

export default DashboardLayout;
```

- Header.jsx:

```
import React from "react";
import { AppBar, Toolbar, Typography, Button } from "@mui/material";
import { Link } from "react-router-dom";
import { useAuth } from "../context/AuthContext";

const Header = () => {
  const { isAuthenticated } = useAuth();

  return (
    <AppBar position="static">
      <Toolbar>
        <Typography variant="h6" sx={{ flexGrow: 1 }}>
          | EcoTrack
        </Typography>

        <Button color="inherit" component={Link} to="/">
          | Dashboard
        </Button>

        <Button color="inherit" component={Link} to="/logs">
          | Logs
        </Button>

        {isAuthenticated ? (
          <Button color="inherit" component={Link} to="/logout">
            Logout
          </Button>
        ) : (
          <Button color="inherit" component={Link} to="/login">
            Login
          </Button>
        )}
      </Toolbar>
    </AppBar>
  );
};

export default React.memo(Header);
```

- App.jsx:

```
import { Route, Routes } from "react-router-dom";
import { Suspense, lazy } from "react";
import ProtectedRoute from "./routes/ProtectedRoute";
import Header from "./components/Header";

const Login = lazy(() => import("./pages/Login"));
const Logout = lazy(() => import("./pages/Logout"));
const DashboardLayout = lazy(() => import("./pages/DashboardLayout"));
const DashboardSummary = lazy(() => import("./pages/DashboardSummary"));
const DashboardSettings = lazy(() => import("./pages/DashboardSettings"));
const DashboardAnalytics = lazy(() => import("./pages/DashboardAnalytics"));
const Logs = lazy(() => import("./pages/Logs"));

function App() {
  return (
    <>
      <Header />
      <Suspense fallback={<h2>Loading...</h2>}>
        <Routes>
          <Route path="/login" element={<Login />} />
          <Route path="/logout" element={<Logout />} />
          <Route
            path="/"
            element={
              <ProtectedRoute>
                <DashboardLayout />
              </ProtectedRoute>
            }
          >
            <Route index element={<DashboardSummary />} />
            <Route path="settings" element={<DashboardSettings />} />
            <Route path="summary" element={<DashboardSummary />} />
            <Route path="analytics" element={<DashboardAnalytics />} />
          </Route>
          <Route
            path="/logs"
            element={
              <ProtectedRoute>
                <Logs />
              </ProtectedRoute>
            }
          />
        </Routes>
      </Suspense>
    </>
  );
}

export default App;
```

5. Output

The image displays three screenshots of the EcoTrack application interface, arranged vertically.

- Dashboard:** The top screenshot shows the dashboard page. It features a blue header bar with the "EcoTrack" logo on the left and "DASHBOARD" "LOGS" "LOGOUT" links on the right. Below the header is a section titled "Dashboard" with three buttons: "SETTINGS", "SUMMARY" (which is highlighted in blue), and "ANALYTICS". A text area below the buttons contains the placeholder text "This is a Summary".
- Login:** The middle screenshot shows the login page. It has a blue header bar with the "EcoTrack" logo. Below the header is a large blue button with the word "Login" in white text.
- Logs:** The bottom screenshot shows the logs page. It features a blue header bar with the "EcoTrack" logo on the left and "DASHBOARD" "LOGS" "LOGOUT" links on the right. Below the header is a section titled "Logs" containing a list of three items:
 1. Car Travel: 4 kg CO2
 2. Electricity Usage: 6 kg CO2
 3. Cycling: 0 kg CO2A text area below the list states "Total Carbon: 10 kg CO2". At the bottom of this section is a small "Refresh" button.

6. Learning Outcome

- We learnt about React Apps and how to create them.
- We learnt about redux and its components.
- We learnt about the use of thunks and Slices.
- We learnt about Authentication and index pages
- We learnt the use of MaterialUI and useSelector.
- We learnt about the flow of a React project.