**Objectives**

**1. Define SPA and its Benefits**

**SPA (Single Page Application)** is a web application that **loads a single HTML page** and dynamically updates the content as the user interacts with the app, without refreshing the whole page.

**Benefits of SPA:**

* **Faster User Experience**: Only data is exchanged, not full pages.
* **Reduced Server Load**: Fewer full-page reloads reduce server requests.
* **Smooth Navigation**: Pages appear to load instantly.
* **Rich Interactivity**: Enables mobile-app-like interfaces.

**2. Define React and Identify Its Working**

**React** is a **JavaScript library** developed by Facebook for building **user interfaces**, especially for **single-page applications**.

**How React Works:**

* Uses **components** to build UI.
* Manages application state efficiently.
* Utilizes **virtual DOM** to update only the necessary parts of the real DOM.

**3. Differences Between SPA and MPA**

| **Feature** | **SPA (Single Page App)** | **MPA (Multi Page App)** |
| --- | --- | --- |
| Page Loading | Loads a single HTML page | Each page reloads completely from the server |
| Speed | Faster after initial load | Slower due to full reloads |
| Navigation | Dynamic using JavaScript | Traditional page navigation |
| Code Splitting | Requires advanced techniques | Naturally separated into multiple pages |
| SEO | Challenging (can use SSR for improvement) | Better SEO out-of-the-box |
| Example | Gmail, Google Maps | Amazon, Facebook login pages |

**4. Pros & Cons of Single Page Applications**

**Pros:**

* Fast and responsive UI
* Reduced server traffic
* Reusable components
* Good for dynamic content apps (e.g., dashboards)

**Cons:**

* Poor SEO (without SSR)
* Initial load may be heavy
* Browser history management can be tricky
* Security (e.g., XSS) must be handled properly

**5. Explain About React**

React is a **declarative, component-based** JavaScript library used to build modern, responsive web applications. It:

* Enables building reusable UI components.
* Encourages unidirectional data flow.
* Works well with other libraries and frameworks.
* Uses JSX (JavaScript XML) for HTML-like syntax inside JS.

**6. Define Virtual DOM**

The **Virtual DOM (VDOM)** is a **lightweight JavaScript representation** of the actual DOM.

**How It Works:**

1. When a component’s state changes, a new virtual DOM is created.
2. React compares the new VDOM with the previous one (**diffing**).
3. It updates only the parts of the real DOM that changed (**reconciliation**).

**Benefits:**

* Faster DOM updates.
* Better performance compared to direct DOM manipulation.

**7. Features of React**

* **JSX**: HTML-like syntax in JavaScript
* **Components**: Reusable pieces of UI
* **Virtual DOM**: Improves performance
* **Unidirectional Data Flow**: Easy to debug and manage state
* **React Hooks**: Manage state and lifecycle in functional components
* **React Router**: Enables SPA routing
* **High Performance**: Due to virtual DOM and efficient updates
* **Strong Community and Ecosystem**

**OUTPUT:**

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