**1. Define SPA and Its Benefits**

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

**Benefits of SPA:**

* Fast performance (only necessary data is fetched).
* Smooth user experience (no page reloads).
* Reduced server load.
* Efficient front-end routing using JavaScript frameworks like React.

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

**React:**  
React is an open-source JavaScript library developed by Facebook for building user interfaces, especially for SPAs.

**Working of React:**

* Uses components to build UIs.
* Maintains a virtual DOM.
* On UI changes, it compares the virtual DOM with the real DOM and efficiently updates only the changed parts (diffing & reconciliation).

**3. Identify the Differences Between SPA and MPA**

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| --- | --- | --- |
| **Feature** | **Single-Page Applications (SPAs)** | **Multi-Page Applications (MPAs)** |
| Performance | Faster after initial load, smooth transitions | Slower page transitions, full reloads |
| User Experience | Seamless, app-like feel | Traditional web experience |
| Initial Load Time | Slower due to larger initial payload | Faster due to smaller initial payload |
| SEO | More challenging due to JavaScript rendering | Easier due to server-rendered HTML |
| Development Complexity | More complex, requires SPA frameworks | Simpler, uses traditional web technologies |
| Scalability | Easier to scale due to modular structure | More difficult to scale due to monolithic structure |
| Offline Support | Easier with service workers and caching | More challenging without additional effort |
| Browser History | Handled by SPA framework | Handled by browser natively |
| Code Organization | Modular, component-based architecture | Monolithic, page-based architecture |
| Tooling and Ecosystem | Rich ecosystem, active development | Mature ecosystem, well-established |

**4. Explain Pros & Cons of Single-Page Application**

**Pros:**

* Better user experience (no reloads).
* Faster interactions after initial load.
* Efficient code reusability and front-end routing.

**Cons:**

* Slower initial load time.
* SEO can be challenging.
* Requires JavaScript enabled.
* Complexity in managing state and routing.

**5. Explain About React**

* React is a component-based JavaScript library used for building dynamic and interactive UIs.
* It follows a declarative programming style, making code predictable and easier to debug.
* React can be used to build SPAs, mobile apps (using React Native), and even parts of MPAs.
* Developed and maintained by Meta (Facebook).

**6. Define Virtual DOM**

**Virtual DOM:**  
A virtual representation of the real DOM. React maintains this in memory to track changes and updates efficiently.

**Working:**

* React creates a **virtual DOM** tree.
* On changes, it compares the new tree with the old (diffing).
* Then updates only the parts of the real DOM that changed (reconciliation), improving performance.

**7. Features of React**

* Component-based Architecture
* Virtual DOM for fast rendering
* One-way data binding
* JSX (JavaScript + HTML-like syntax)
* Reusable code
* React Hooks for managing state and lifecycle
* Support for SPA with React Router
* Large ecosystem and community support

