WEB TECHNOLOGIES

Single Page Applications

Prof. Pavan A C
Department of Computer Science and Engineering

Acknowledgement:
Teaching Assistants(Harini B and Chandana MS)

What Is an SPA?

Definition: A **Single Page Application** loads a single HTML page, then dynamically updates it with JavaScript as users interact. No full reloads.

Key Point: It behaves more like a **native mobile app** than a traditional website.

Examples: Gmail, Netflix, Trello, Google Maps.

Why important: Faster, smoother UX -> today’s standard for modern apps.

Analogy: It’s like scrolling Instagram - you keep seeing new posts, but the app never reloads.

How SPAs Work

Initial Load: Browser gets HTML + JS + CSS in one shot.

Interactions: Future data requests go via **AJAX / Fetch / GraphQL APIs**, updating only parts of the DOM.

Under the Hood: Uses client-side routing (via `history.pushState` or frameworks like React Router).

Outcome: Pages feel seamless, transitions are instant.

Tech Note: React, Angular, Vue are the most common SPA frameworks today.

Why SPAs are Awesome

- **Speed**: Faster after first load -> less bandwidth used.
- **App-like UX**: Smooth transitions, no page flicker.
- **Separation of Concerns**: Backend provides APIs; frontend handles rendering.
- **Developer Benefits**: Easier to build modular UIs, better reuse of components.
- Nobody likes waiting… SPAs are like 2x speed on YouTube but for websites :)

The Flip Side — SPA Challenges

SEO: Dynamic rendering makes it hard for crawlers (workarounds: SSR, pre-rendering).

Routing/History: Back/forward buttons don’t work automatically -> need JS libraries.

Performance: Initial bundle can be heavy (100s of KBs/MBs).

Security: Client-side code = more exposed attack surface.

Extra Info

Multi-Page Application (MPA)

Definition: A **Multi-Page Application** loads a **new HTML page from the server** every time the user navigates or submits something.

Workflow:

1. User clicks -> request sent to server

2. Server processes -> sends back a new HTML page

3. Browser replaces the old page with the new one

Examples: Old portals (IRCTC, SBI net banking), news sites, blogs.

Multi-Page Application (MPA)

Strengths:

- SEO-friendly (pages are easy for search engines to crawl).
- Easier security handling (logic mostly on the server).
- Good for content-heavy sites.

Limitations:

- Slower UX (page reloads each time).
- More bandwidth consumption.
- Choppier navigation.

Think of an MPA as a waiter who brings you a new plate every time you order something, instead of just topping up your plate (which is what SPA does).

Extra Info

SPA vs MPA

Feature	SPA	Traditional MPA
Reloads	None after first load	Full reload on every click
Speed	Instant after load	Slower, multiple round trips
SEO	Needs extra handling	Works out of the box
UX	Seamless, app-like	Choppy, page-to-page
Dev Model	API + JS rendering	Server renders HTML each time

Real World: Flipkart web app = SPA-like; old government portals = MPAs.

Common Use Cases

SPAs shine in:

- Email apps (Gmail, Outlook)
- Project boards (Trello, Jira)
- Streaming (Netflix, Hotstar)
- Dashboards & analytics apps

Not ideal for:

- Blogs, news sites, or anything SEO-heavy.

Mnemonic: If it’s interactive -> SPA; if it’s mostly static info -> MPA.

SPA

Best Practices & SPA Hygiene

- **Optimize Initial Load**: Use **code splitting, lazy loading**.
- **Handle SEO**: SSR (Next.js, Nuxt.js) or pre-rendering.
- **Routing**: Use libraries like React Router or Angular Router.
- **Caching**: Service Workers for offline/PWA experience.
- **Security**: Sanitize inputs, avoid exposing secrets in client code.
- Tip: Always test SPAs on 3G/4G networks -> real-world users won’t always have WiFi.

References

- Wikipedia – Single Page Application
- Bloomreach – What is a Single Page Application?
- Adobe Business Blog – Benefits of SPAs
- Netguru – SPA Pros & Cons
- Digiteum – SPA Features & Use Cases
- NetSolutions – SPA Insights & Architecture
- Medium – SPA vs MPA Comparison
- Wired – SPA Routing & History Issues
- StackOverflow – SPA Advantages & Disadvantages

MCQs

Q1. What is the main characteristic of a Single Page Application (SPA)?

a) Each user action reloads the entire page

b) Only one HTML page is loaded, content updates dynamically

c) Every request renders a new HTML page on the server

d) It works only with PHP backends

Answer: b) Only one HTML page is loaded, content updates dynamically

Q2. Which of the following is a *challenge* in building SPAs?

a) Smooth user experience

b) Back/forward navigation handling

c) Faster interactions after first load

d) Clear separation of frontend & backend

Answer: b) Back/forward navigation handling

SPA
MCQs

Q3. Which technology or feature is most commonly used to fetch data in SPAs without reloading the page?

a) HTML forms

b) AJAX / Fetch API

c) PHP sessions

d) Cookies

Answer: b) AJAX / Fetch API

THANK YOU

Prof. Pavan A C

Department of Computer Science and Engineering