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MPL Assignment 02

Q1 Define Progressive Web App (PWA) & explain its significance in modern web development. Discuss the key characteristics that differentiate PWAs from traditional mobile apps.

A. A Progressive Web App (PWA) is a type of web application that works like a mobile app but runs in a browser. It can be installed on a device, works offline & provides a fast & smooth user experience.

Significance of PWA in Modern Web Development :

1) Cross Platform Compatibility : Works on both mobile & desktop with a single codebase
2) Offline Support : Can function without the internet using cached data.
3) Fast Performance : Loads quickly, even on slow networks.
4) No App Store Required : Users can install it directly from the browser
5) Lower Development Cost : One PWA can replace separate Android & iOS apps.

Key Differences Between PWA & Traditional Mobile Apps :-

Feature	PWA	Traditional Mobile App
Installation	Direct from browser	Download from App Store

Internet Required	Works offline with caching	Usually requires internet
Performance	Fast with service workers	Faster but need installation
Updates	Automatic, no app store approval	Manual update needed.
Development Cost	Lower (one codebase for all)	Higher (separate apps for each p

PWAs combine the best of web & mobile apps, ma them efficient & user-friendly.

Q2 Define responsive web design & explain its imp ance in the context of Progressive Web Apps. C & contrast responsive, fluid & adaptive web design approaches.

Soln. Definition of Responsive Web Design :

~~Respective~~ Web Design (RWD) is a technique th makes web pages adjust automatically to differe screen sizes & devices. It ensures a good use experience on mobiles, tablets & desktops withou needing separate versions of a website.

Importance of Responsive Design in PWAs :

1) Better User Experience : PWAs work smoothly any device.

2) Faster load Time : Optimized design improves speed

3) SEO Benefits : Google ranks responsive sites higher

4) Cost-effective : No need to build multiple versions for different screens.

Comparison ~~for~~ of Web Design Approaches :-

Approach	How it Works	Pros	Cons
Responsive	Uses flexible grids & CSS media queries to adjust layout	Works on all devices, improves SEO	Can be complex to design
Fluid	Uses percent-based widths instead of fixed pixels, so elements resize smoothly	Works well on different screen sizes, easy to implement	less control over layout on large screens
Adaptive	Uses fixed layouts that change at specific breakpoints	Optimized for known screen sizes	More effort required to design for each screen size

Key Differences :

- Responsive adopts dynamically to all screens
- Fluid resizes smoothly but may not be fully optimized

- Adaptive loads different layouts based on type

Responsive design is best for PWAs because it a seamless experience on all devices.

Q3 Describe the lifecycle of Service Workers, inc registration, installation, & activation phases

Soln. Lifecycle of Service Workers

A Service Workers is a script that runs in th background & helps a web app work offline, l faster & send push notifications. Its lifecyc has three main phases :-

1) Registration Phase :- The browser registers Service Workers using JavaScript.

Code Example :-

```
if ('serviceWorker' in navigator){
    navigator.serviceWorker.register('/sw.js')
        .then(() => console.log('service worker registe
        .catch(error => console.log('failed:', error));
}
```

- This tells the browser to install & activate Service Worker

2) Installation Phase
- The Service Worker downloads necessary files (HTML, CSS, JS) & stores them in cache
- If successful, it moves to the activation phase

Code Example :-

```
self.addEventListener ('install', event => {
    event.waitUntil(
        caches.open ('app-cache').then (cache => {
            return cache.addAll (['/', '/index.html',
                                  '/styles.css']);
        })
    );
}
```

- This ensures the app loads even without the internet

3) Activation Phase

- The old Service Worker is replaced with a new one
- Unused cache files from the previous version are deleted

Code Example :-

```
self.addEventListener ('activate', event => {
    event.waitUntil(
        caches.keys ().then (keys.map (key => {
            if(key !== 'app-cache'){
                return caches.delete (key);
                }
            }));
        })
    );
});
```

- The Service Worker is now fully active &
controls network requests.

Final Step : Fetch & Sync

Once activated, the Service Worker intercep
network requests, serves cached files, & sync
data when the internet is available.

This lifecycle makes PWAs faster, more relial
& capable of working offline.

Q4 Explain the use of IndexedDB in the Servic
Worker for data storage.

Soln. Use of IndexedDB in Service Wooker for D
Storage

IndexedDB is a browser database that stores
large amounts of structured data like JSON o
It helps PWAs work offline by saving & re
ing data efficiently.

Why Use IndexedDB in Service Workers?

1) Offline Support : Stores data when offline & syncs it later.
2) Efficient Storage : Saves ~~stor~~ structured data like user settings, cart items, or form inputs.
3) Faster Access : Retrieves data quickly without needing a network request.
4) Persistent Data : Data remains saved even after the browser is closed.

How Service Workers Use IndexedDB?

Opening the Database

```
let db;
let request = indexedDB.open('MyDatabase', 1);

request.onsuccess = function (event) {
    db = event.target.result;
};
```

Creating a Store & Adding Data

```
request.onupgradeneeded = function (event){
    let db = event.target.result;
    let store = db.createObjectStore('Users', {keyPath:
                                                'id'});
    store.add ({id: 1, name: 'John Doe', age: 25});
};
```

Fetching Data in Service Worker

```
let transaction = db.transaction('Users', 'readonly');
let store = transaction.objectStore('Users');
let getUser = store.get(1);

getUser.onsuccess = function (){
    console.log (getUser.result);
};
```