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MPL   Assignment 2

Q1 Define Progressive Web App (PWA) and explain its significance in Modern web development. Discuss the key characteristics that differenciate PWAs from traditional Mobile Apps.

→ Solution :

A Progressive Web App (PWA) is a web application that leverages modern web technologies to deliver an app like experience to users it combins the best feature of web and mobile apps. offering fast performance. offline capabilities & cross platform support without requiring installing from an APP store.

SIGNIFICANCE IN MODERN WEB DEVELOPMENT:

a) **Improved User Experience:**
PWAs provide a smooth app like interface with responsive design

b) **Offline functionality:**
Service workers enable caching, allowing PWAS to work without an internet connection

c) **Cross platform Compatibility**
A single code base runs on different devices (desktop, mobile, tablet)

d) **Cost - Effective Development**
Eliminates the need to develop seperate apps for Android & ids

e) **No App store Dependency**
Users can install PWAs directly from browser, reducing installation barriers.

Key Characteristics Differentiation PWA from Traditional Mobile Apps

Feature	PWA	Traditional Mobile App
• Installation	Added to the home server via browser	installed via app store
• Performance	Fast and lightweight	May consume more storage & memory
• offline Access	Works offline with cached data	fully functional offline
• Updates	Auto-updated from the Web	Requires manual updates via Store
• Platform	Runs on browsers	Platform specific
• Development Cost	Lower	Higher

Q2] Define responsive web design & explain its importance in the context of Progressive Web Apps Compare and Contrast responsive, Fluid and adaptive web design approaches

→ Solution:-
Responsive Web Design (RWD) is a web development approach that ensures websites automatically adjust their layout, content and elements based on the users device screen size, resolution and orientation. It uses flexible grids, media queries and scalable images to create a seamless experience across desktops, tablets and smartphones.

Importance of RWP in PWA:

a) Enhanced user Experience

PWA aims to work smoothly across devices & ensures
Consistent UI /UX

b) Improved Accessbility

Users can Access PWA on any screen Size without usability
issues.

c) Faster Load time

Optimized layout and images improve performance, which
is critical for PWAs.

d) SEO Benifits.

Google priorities mobile friendly Sites, boosting,
Search rankings.

e) Cost Effective

A single responsive design eliminates the need for seprate
mobile and desktop versions.

Comperision of Responsive Fluid & Adaptive Web Design

Responsive	Fluid	Adaptive
① Uses CSS media queries to adjust layout based on screen Size	Uses percentage-based layout for flexible Scaling	Uses predefined layout for specific screen Size
② Highly flexible	Fully Flexible	Less Flexible
③ optimized for all devices	Can be inconsistent on very large screen	May load unnecessary element for non matching screen Size
④ Moderate Implementation	Simple Implementation	Complex implementation
⑤ Best For	Modern Website	Apps / website

Q3] Describe the life cycle of service workers including registration, installation, and activation phases.

→ Solution:

Life cycle of Service workers:

it has three main phases

a) Registration

- The service worker is registered in the JavaScript code using navigator.service worker.register ().
- This tells the browser where to find the service worker script and initiates its lifecycle

```
if ('service worker' in navigation) {
    navigator.serviceworker.register ('/service-workers.js')
    • then (reg => console.log ('Service worker Registered' reg)
    • catch (err => console.log ('Serviceworker Registration Failed' err)).
```

b) installation

- After registration, the browser tries to install the service worker
- The install event is triggered where resources can be preloaded.
- If successful, the service worker moves to the activation Phase; otherwise it retries installation

```
self.addEventListener ('install', event => {
    event.waitUntil (
        caches.open ('v1').then (cache => {
            return cache.add All [[' /index.html', '/style.css',
            '/script.js'];
        })
    );
3.});
```

(C) Activation

- Once installed, the activate event is triggered.
- The 'old caches or outdated service workers are cleaned up in this phase
- The service worker takes control of clients and starts handling fetch events.

```
Self.addEventListener('activate', event => {
  event.waitUntil (
    Caches.Keys().then (keys => {
      return Promise.all (keys.map (key => {
        if (key !== 'v1') {
          return caches.delete (key);
        }
      })
    );
  })
  )
);
});
```

Q4.] Explain the use of indexed DB in the service worker for data storage

→ Solution:-

Indexed DB is a client-side, NoSQL database that allows web applications to store structured data in the browser. When combined with a service worker, it helps enable offline functionality and efficient caching of data

use of indexed DB in a service worker.

a) Unlike Cache API, which mainly store request/response objects. indexed DB allows storing structured data like JSON objects, user preferences and application states.

(b) Offline Support
Enables users to access and modify data even when
offline. The data can later sync with the server
when online.

(c) Efficient Caching
Stores large amounts of data that don't need to be
re-fetched from the network, reducing load & times.

(d) Background Sync
Works with Background Sync API to sync data
once the internet is available.