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Progressive Web App - The future of Web Development

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Abstract: Research support that 20% of app users are lost between user's initial contact with app and first experience. App can be downloaded and installed from app store. Progressive web app enables the user to instantly go through the app, thus skipping downloading and installation stages. And on returning to app they will be instigated to install the app and upgrade to a full screen experience.
However, a native app has its own set of advantages. Mobile applications with push notification are able to sustain their users up to 3 times more than their equivalents. In addition, the end user would prefer mobile application over website, as mobile application consumes less data and is quicker as resources are saved on the device.
Thus, a progressive web app has improved user withholding and performance and reduced complexity in up keeping a mobile application.
Keywords: Progressive Web Application, Web application manifest, Service workers, IndexedDB

I. PROGRESSIVE WEB APPS - INTRODUCTION

A progressive web app (PWA) is a web app that uses modern web capabilities to deliver an app like experience to end-users. These apps meet specific criteria, and are deployed to servers, accessible through URLS and indexed by search engines. It was coined by Alex Russell and Frances berriman. According to Alex, these apps are websites that took all the right vitamins.
Source code for the native [1] applications as the name suggests is specific for a particular application therefore it is known as non-reusable code; reusability of code is desired not only in a particular application but also across platforms; this functionality is not served by native applications. This results in separate projects and separate environment for developers working on similar or even sometimes same applications.
To combine the best of web and mobile apps, a progressive web application takes advantage of the latest technologies.
It acts & feels like an app but think of it as a website built using web technologies.
Users can install web apps to their home screen, receive push notifications and even work offline due to the recent advancements in the browsers & in the availability of service workers and in the cache & push APIs.
Because of the relative ease of development & the almost instant wins for the application's user experience, they have already attracted lot of attention. It was originally proposed by Google in 2015. When compared to a native application in the respective app stores, progressive web apps take advantage of the much larger web ecosystem, plugins and community & the relative ease of deploying & maintaining a website. You will admire if you develop on both mobile & web, that a website can be built in less time and an API does not need to be maintained with backwards- compatibility (all users will run the same version of your website's code, unlike the version fragmentation of native apps) and that the app will generally be easier to deploy and maintain.
Earlier companies had to employee specialized human resources for native application development required for each platform. Solution to this problem has been made possible by progressive web application [2] for cross or inter- platform development; development time as well as time to deploy an application to market is also reduced.

A. Why do we Need a Progressive Web App?

Progressive web application, [3] hybrid web application, native web application and other such technologies should be included at academic levels at various Institutions and Universities.
Computer science industry and information technology industry is investing a lot in these technologies so as to learn their advancements and further enhancements. This field of technology still requires a lot of research and has a lot of scope and advantages yet to be explored.

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B. Let's Discuss About The User Engagement With Native & Web Apps

1) *Fast:* PWAs provide user experiences at a faster rate. When a user downloads an app from that moment they start interacting with it, and here everything happens very fast. Since PWA can cache the data, it is very fast to start the app again without caring about the network.
2) *Integrated User Experience:* PWAs provides feel like native apps and have access to device functionalities. It sends push notifications like native apps.
3) *User Engagement:* mobile web reach is almost three times that of native apps but the users spend most of their time in native apps and due to this only some of the users are actively engaged. However, users are spending their 80% time on top three native apps.
4) *Slow Website Load:* Do you ever imagined that a user waits for less than 5 seconds to click the "close X" button if a website is too slow and about less than 55% of them abandon a website.
5) *Background Sync:* Background synchronization is provided by PWA implementation to support offline access. This synchronizes the sent data even throughout offline access. After the cache process the app should work offline and navigates through pages. Using the background sync. the application is enhanced to store requests sent during offline access
6) *Internet Speed:* About large number of our population still using 2G or 3G internet. Dial up connection is used to access the same even in the US.

C. Characteristics of Progressive Web App

1) Progressive app can work on any device. It can take advantage any feature available on the user's device. This is the main advantage of this app.
2) A progressive web app should fit the devices from factor and screen size.
3) Another important factor is that it should be look like a native app. So that it can be access easily.
4) It should have proper connectivity. It should work in low connectivity or offline.
5) Basically it's a website, so it can be find easily in search engines. Native apps are lagging behind in this area.
6) Progressive apps are linkable. To indicate the current state of the app a well –designed website should use the URL.
7) It should engage its users through various push notifications etc.
8) It should be installed easily. It should be easily installed on home screen so that user can access it.
9) Whenever any new content is added, it should easily reach to the user through refresh app available in the app.
10) Last but not the least it should be safe for the users so that nobody can misuse private information of the user.

II. HOW CAN WE BUILD ONE?

While browsing a website, you have seen 'Add to home screen' banner & when you click on it the application installs itself in the background. When you open this application, you can browse the application in your mobile phone rather than browser.
Now, you have a mobile app which was downloaded from a web application and that would be done without using app store.
It was easy to get an app but the best part is that you can browse the content without having internet. You have offline access to the app.
This is a progressive web app only and it is available on your phone like a native app, and works offline just like a native app.

A. Development of PWA

1) *Application Shell:* The application shell is the minimum HTML, CSS and JavaScript' required powering a user interface. A native mobile app has some limitations like it includes application part of its distributable and if we talk about website ordinarily requests this over the network. Whereas progressive web applications bridge this by the application shell's resources and assets in the browser's cache. The Sky High application shell consists of the top header bar, the fonts and any CSS required rendering these beautifully. To start with service workers, users first need to create their service worker's JavaScript file, sw.js, placed in the root directory. For building PWA, technologies such as service workers, web app manifests, push notifications and IndexedDB/local data structure for caching are required. Let's look into them in detail.
2) *Service Workers:* Most attractive feature of progressive app is that user can work offline. This is possible that user can access previous sessions of the app. Side by side it shows that users are not connected. Once he is connected he can access the data from the server. All these features are possible through service workers, which are event driven scripts written in JavaScript. It

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has access to domain-wide events. It includes network fetches. With them we can cache all static resources, which could drastically reduce network requests and improve performance properly.

3) *Web Application Manifest:* The web app manifest is a simple JSON file and it generally resides in the root folder of a web app which is used to inform the browser about web application and how it should behave when 'installed' on the user's device. Manifest is required by Google Chrome to show the Add to Home Screen prompt. Information like the app name, icons, the starting URL it should start at when launched, and more are included in a manifest file.
4) *Push Notifications:* It allows users to choose in to timely updates from the app they believe, it can help them to rearrange with the application. These notifications allow users to engage with their audience even when the browser is the Push API is supported in Chrome, Opera and Samsung's browsers and is under development in Firefox and Microsoft Edge. Unfortunately, there is no indication that the feature will be implemented in safari.
5) *Offline Test:* A user can conduct online test. A user can run the app without connection will simply result in the application shell and the offline warning being displayed – an improvement over Chrome's prowling t-rex. Once the user has established a network connection, the warning will be disabled and retrieve the latest data.
6) *Indexed DB/local Data Structure:* An amount of work is involved when a website or application loads first time and also during constructing the initial application state. IndexedDB is used to store app state to speed up the load time for repeat visits. In background API services can be sync up with the app and update the UI. IndexedDB is an alternative to the Web SQL (deprecated) database which supports many data types like number, string, JSON, blob, and so on. IndexedDB can temporary store user generated contents before uploading to server or as a client-side cache of remote data. This can improve user experience, but using it incorrectly can lead to broken apps.

III. EXAMPLES OF PROGRESSIVE WEB APPS

A. *Ali Express*

A popular e-commerce site owned by the Alibaba Group. AliExpress [5] witnessed incredible results after changing to a Progressive Web App:

1) 104% increase in conversions for new users
2) 2x more pages visited per session
3) 74% increase in time spent per session

B. *Flipkart*

Flipkart is India's largest e-commerce site. Flipkart Lite is their mobile site to a Progressive Web App.
Flipkart Lite provides fast and streamlined experiences to mobile users. Flipkart Lite [6] brought in some amazing results:

1) 70% increase in conversions
2) 40% higher re-engagement
3) 3x more time spent on site
4) 3x lower data usage

C. *Forbes*

Top U.S. business magazine "Forbes" that publishes articles on several topics. To improve its mobile web user experience this magazine recently developed a Progressive Web App.
Here are some of the key results [7]:

1) 43% increase in sessions per user
2) 20% increase in impressions per page
3) 100% increase in engagement rates
4) 6x increase in the number of readers completing articles

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IV. FUTURE OF PWA

In the recent Google chrome summit [4], Google signaled at going big in the progressive app space. Main reason is the substantial reach chrome has on the mobile users. With over 2 Billion chrome instances active, the browser might well be the icon people reach in the mobile for all their app and browsing requirements. While Google is going all out on progressive web apps, Apple has still kept PWA in under consideration bracket, but Industry pundits are positive that the day is not far when Apple will revolutionize the PWA space. Though iOS doesn't support all PWA features yet, PWAs have been found to work better in iOS than their native websites.

Unlike native app where user needs to find, download, install and then can use, the progressive web app user can start using the app immediately, which is its biggest advantage. Another advantage of progressive web app is push notification also PWA are faster in resource usage on the mobile devices

Staying away from native apps' pain points, progressive app gives you the advantage of a native app, like performance, user retention, and offline usage. Similarly, PWA inculcates the best features of a responsive website, such as latest updates, access via any browser, and security. Thus the progressive app is a win-win for both the customers and businesses.

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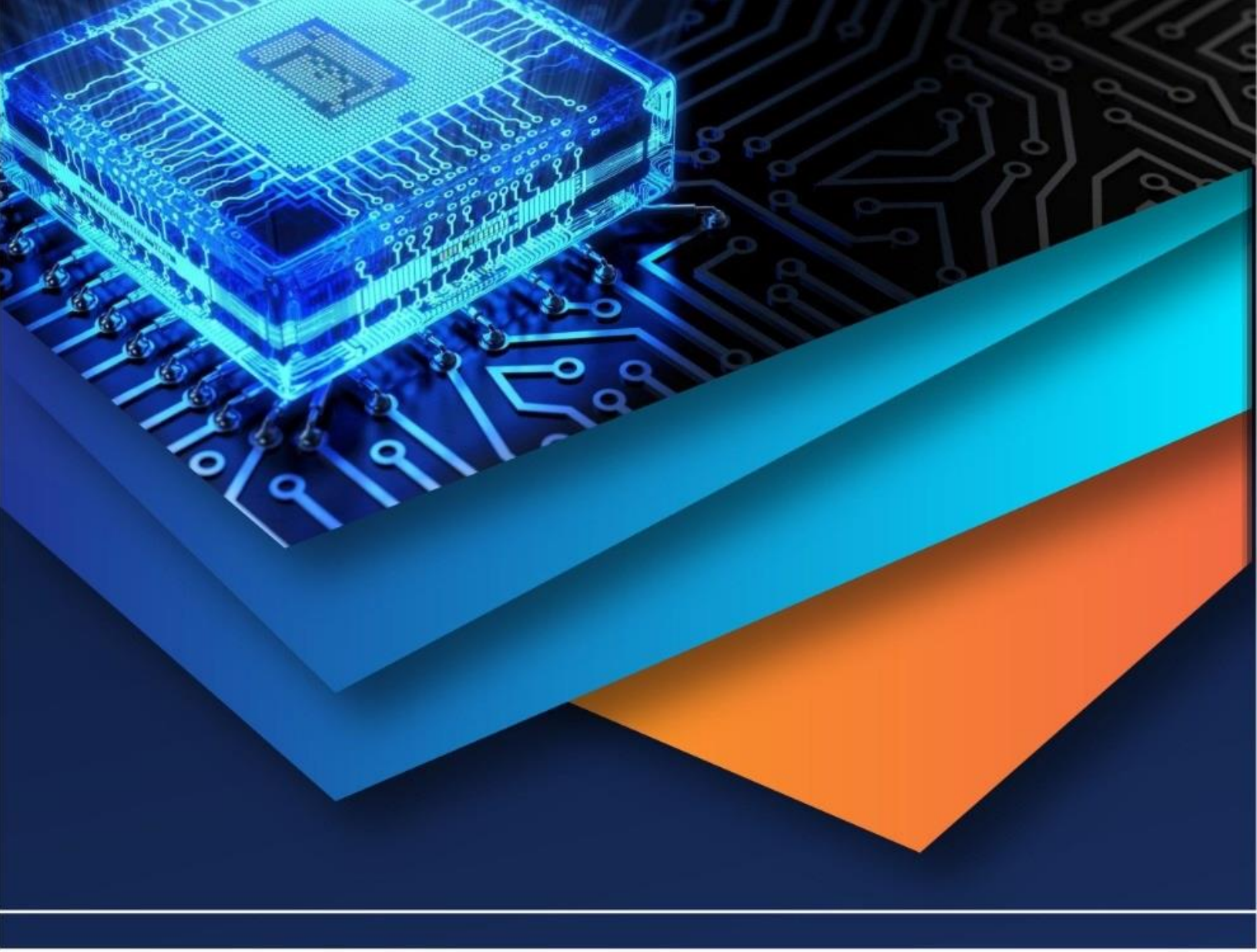

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