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- 1) Xamarin
- 2) React Native
- 3) Flutter
- 4) Ionic
- 5) Sencha Touch
- 6) Onsen
- 7) PWA

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- 5) PWA
- 6)

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1		09.11.2021 – 10.11.2021	
2		10.11.2021 – 13.11.2021	
3		14.11.2021 – 15.11.2021	
4		16.11.2021 – 18.11.2021	
5		19.11.2021 – 21.11.2021	
6	PWA	26.11.2021 – 27.11.2021	
7		27.11.21-29.11.21	
8		30.11.2021	
9		05.12.2021	

8 2021 .

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, ,
, PWA, IOS,
ANDROID, XAMARIN, REACT NATIVE, FLUTTER, HTML5, CSS, IONIC,
SENCHA TOUCH, ONSEN, ANGULAR, VUE.

ABSTRACT

Master's thesis: 67 pages, 4 figures, 0 tables, 1 appendices, 21 sources.

FIREWALL, GATE, INTERNET, PROTOCOL, ROUTER, SERVER, WI-FI, WIRELESS NETWORK, WLAN.

MOBILE APPLICATIONS, NATIVE APPLICATIONS, CROSSPLATFORM APPLICATIONS, HYBRID APPLICATIONS, PWA, IOS, ANDROID, XAMARIN, REACT NATIVE, FLUTTER, HTML5, SENG TO, I WAN ON

The major goal of this thesis is the analysis of modern methods and means of mobile applications.

During the qualification work, the methods and means of developing mobile applications were analyzed, the features were considered, the advantages and disadvantages of each of them were identified. It was determined in which situations which development method is best to use and examples of application are given.

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1.1				11
1.2				12
1.3				13
1.4				15
1.5				16
2				19
2.1				19
2.1.1	Google Android			20
2.1.2	Apple iOS			21
2.2				21
2.2.1	iOS			22
2.2.2	Android			24
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3				28
3.1	Xamarin			28
3.2	React Native			31
3.3	Flutter			34
3.4				37
3.4.1				37
3.4.2				39

IDE – Integrated Drive Electronics

iOS – iPhone operating system

MVC – Model-View-Controller

MVVM – Model-View-ViewModel

LINQ –

API – Application Programming Interface

QA –

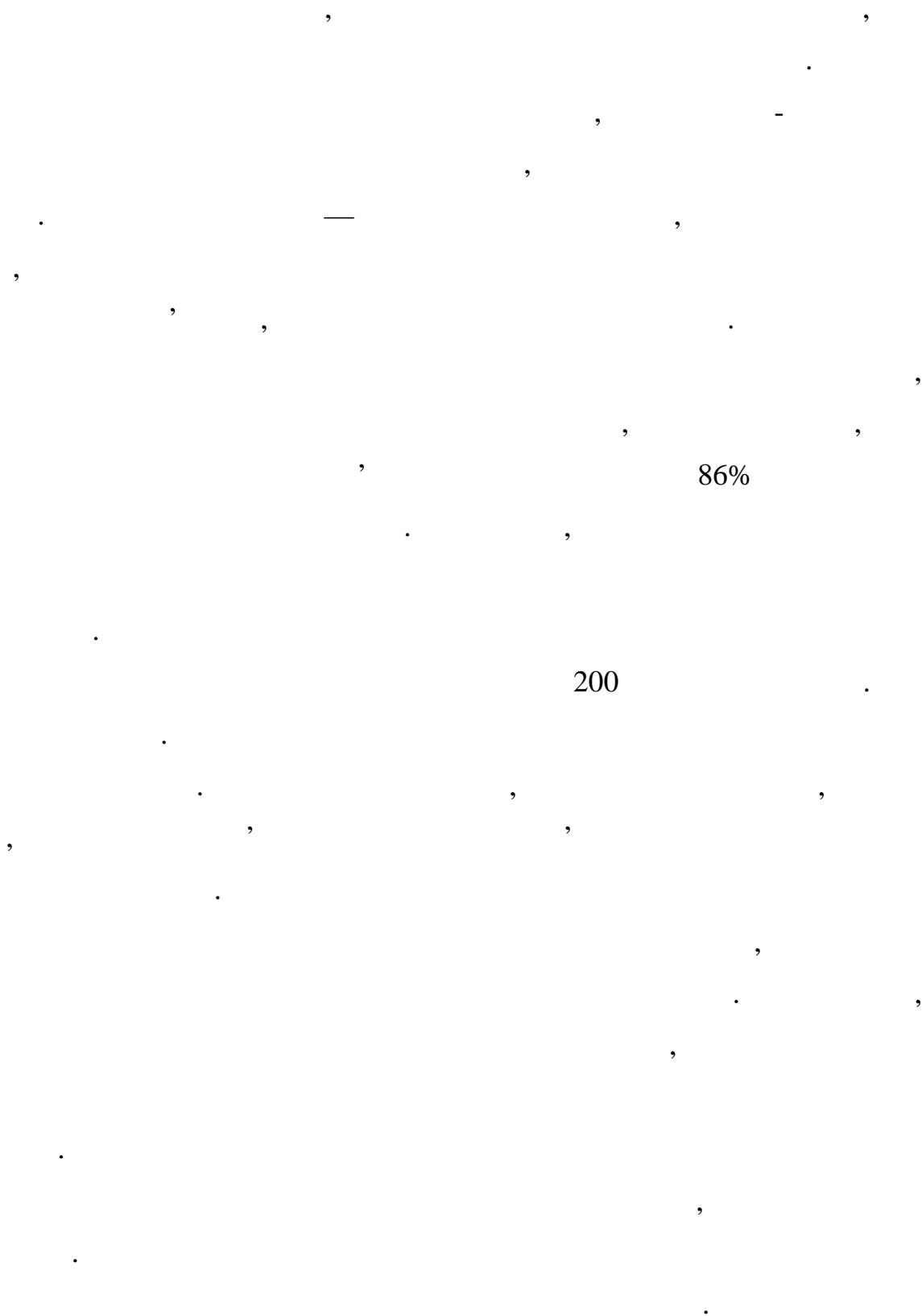
UX Design – User Experience Design

UI Design – User Interface Design

SaaS –

IoT (Internet of Things) – ,

AOT (Ahead of Time) –



Apple,

iOS,

Android.

iOS

Android

(SDK)

Apple

iOS

, Google

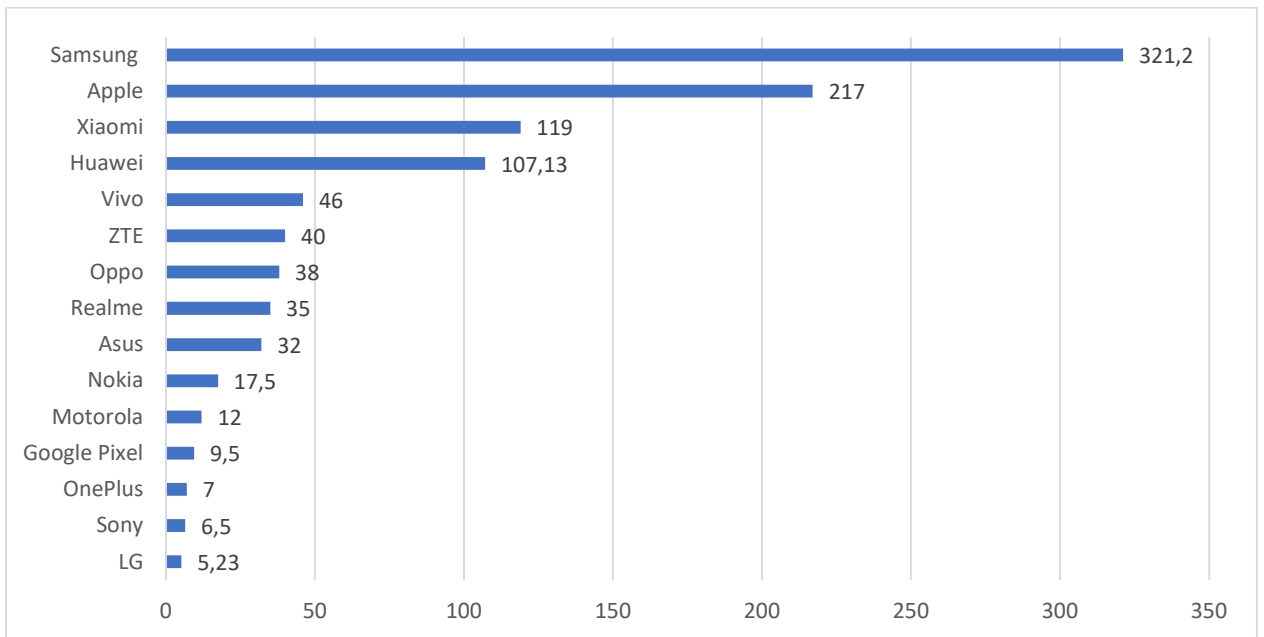
Android

Google

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1.1

174 2009
2013 1,47
2016
2020
1,28 , Samsung Apple,
473
IDC, , -



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	2016	2021			
		73,88%.			
73,47%					
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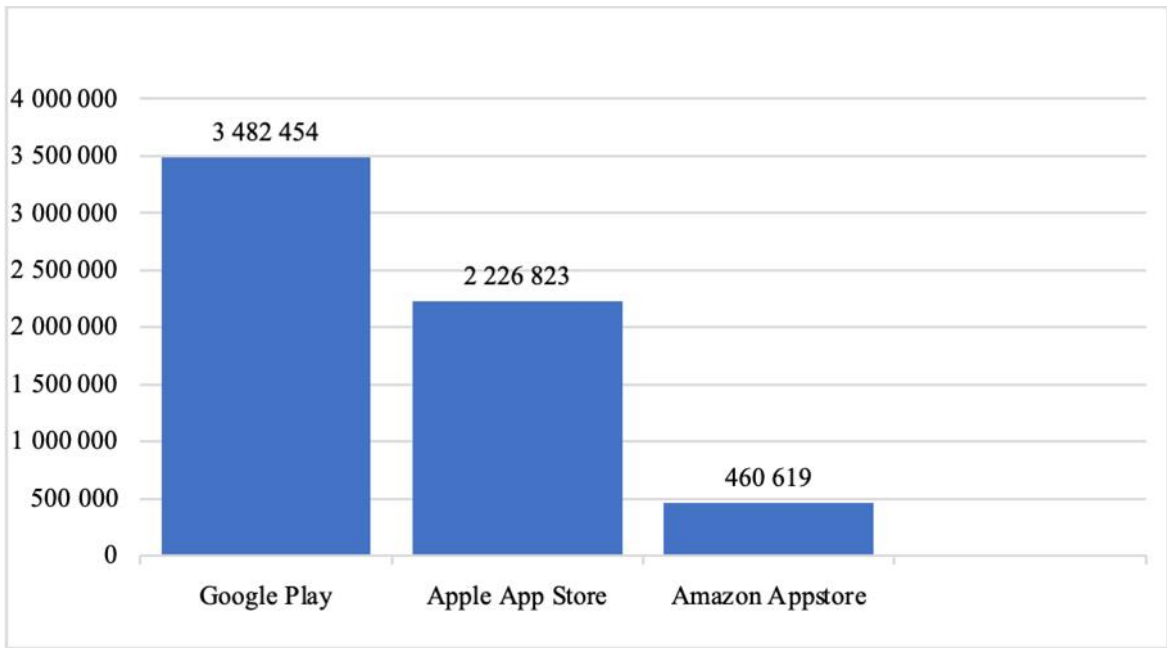
Android
 2021 ,
 73%. Android Google iOS Apple
 99% , 2022
 Android 85,5%.



1.2 – Mobile Operating System – September 2021

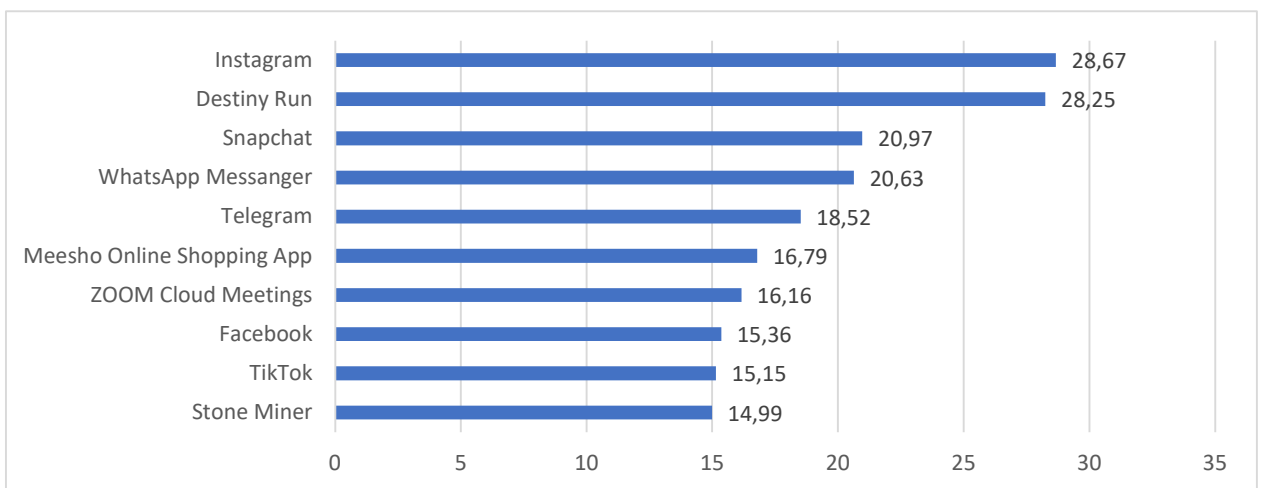
1.3

Apple Google
 Amazon Appstore Android
 Amazon Appstore
 Android, Tencent Appstore
 43840 2021
 2021 Apple App Store
 2,23 Google Play
 3,48 Amazon
 Appstore 461 000



1.3 –

airnowplc.com, 2021 Instagram
 Google Play
 28670000 . «Destiny Run»
 28 . WhatsApp 20,6



1.4 –

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1.4

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 Android iOS.
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 , Android Java iOS
 Swift.
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 , Flutter React Native.
 , iOS Android.
 - , PWA, -
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 HTML5, CSS3
 JavaScript.

Google. PWA

PWA

PWA.

PWA

HTML5, CSS JavaScript,

1.5

GPS

3D-

. Pokemon Go –

2016 App Store.

Android iOS;

Alibaba –

Flutter;

Facebook –

; Slack –

eBay Motors.

eBay,

eBay.

Flutter,

1.0,

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Instagram, Gmail.

Instagram ,

, Instagram -

. Gmail -

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PWA :

- - PWA

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- 70% , ..

PWA Tinder, Uber, Pinterest, Starbucks, Forbes, AliExpress.

Tinder - . ,

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. PWA Uber

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. Pinterest . PWA,

, - . 1%

iOS

Android.

2

— , , ,

Android Apple iOS,

99%, . Android iOS, Windows

Phone, ,

Windows Phone

, GPS,

2.1

, Android iOS.

2.1.1 Google Android

Android – Google, 2008 – Android 12. Google (GMail, Maps, Google Now, Chrome).

Android 72,44% Linux Google Android.

Android Java Kotlin. Android,

(SDK). SDK – Android Android Studio

Google. Android Studio – Android Studio,

Android – Java Development Kit(JDK),

Android.

2.1.2 Apple iOS

Android, iOS . iOS
 Apple 2007 .
 – iOS 15.1. Android, iOS
 Apple (iPhone)
 (iPad).
 , , .
 , 26,75%
 iOS.
 iOS Swift,
 Apple, Objective-C.
 Android iOS
 , , ,
 . Apple , SDK
 iOS «Xcode». , Android Studio,
 . , Android Studio, Xcode
 , ; , Apple
 , macOS. , Apple macOS
 iOS.

2.2

API.

Google Android, Apple iOS

Android

Java, Android Studio

(IDE).

Kotlin

(UI)

XML.

IDE

Android.

Apple –

iOS.

Xcode

Swift

Objective-C.

Xcode.

2.2.1 iOS

iOS

– Objective-C Swift.

Objective-C –

Objective-C

C.

Objective-C –

Apple iOS,

C,

Objective-C , ;
 , Objective-C
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 « » .
 , Objective-C, – ,
 , - .
 Objective-C – , 1980- ,
 , iOS.
 , Objective-C
 , C
 iOS.
 Objective-C Swift, iOS.
 , iOS.
 Swift – iOS, macOS, watchOS,
 tvOS Linux. Apple 2014 .
 Swift
 iOS .
 Swift , . ,
 Swift , ,
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 Swift .
 Swift .
 Swift .
 Swift : apple.com,
 Swift 2,6 , Objective-C, 8,4 , Python.
 Objective C, Swift 20
 2021 (Objective C

25) 8 .

2.2.2 Android

Java Android
 , Android 2008 . Java –
 , - , Sun
 Microsystems 1995 (Oracle).
 , - (C++)
 Android.
 Java " - ",
 Java (JVM), . Java
 , " "
 , .
 Android.
 , Google, 2019 Kotlin
 Android.
 Kotlin – Java (JVM),
 JetBrains, IntelliJ IDEA.
 Java ,
 .
 JetBrains Kotlin 2010 , Kotlin
 1.0 , 2017 , Google
 I/O Kotlin Android.
 Kotlin ,
 Java JavaScript.
 , JetBrains 2012 .
 Kotlin .
 Java ; Kotlin,
 , . ,

Kotlin 20% ,

Kotlin

Kotlin Java – , , ,

Kotlin 100% Java, -

Kotlin, – Java.

Java Kotlin ,

Kotlin Java-

Kotlin – ,

Gradle, Maven .

Kotlin JVM

PYPL, Kotlin 15

2021 .

2.3

Android – Google Play Store,

Apple – App Store. Google Play Store, Android

Huawei AppGallery, Samsung – Galaxy Store,

Amazon,

Google Apple.

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2.4

2.4.1

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API,

2.4.2

Android, iOS

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3

Android, iPhone.
 Google Apple
 API-
 Android,
 iOS.
 Xamarin, React Native Flutter.
 iOS Android.
 React Native, Flutter
 Xamarin.

3.1 Xamarin

Xamarin 2011
 Microsoft 2016
 Xamarin.

Xamarin

Shell, Hot Reload, Hot Restart

Visual,

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Xamarin,

Xamarin

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Xamarin

iOS

IDE,

X-Code. LINQ

Objective-C Java.

Xamarin

MVC MVVM,

MVVM

MVC

Xamarin

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iOS, Android

Windows

Xamarin.forms,

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xamarin.forms

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Xamarin.iOS Xamarin.Android

Xamarin

- Xamarin

C#

Android iOS;

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- Xamarin

96

C# + .Net

iOS Android.

Visual Studio.

IDE

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- Xamarin

, API-

Xamarin,

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Xamarin -

. Xamarin -

Visual Studio Microsoft;

- Xamarin

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Xamarin: HCl Connections, American Cancer Society, Fox Airports, Alaska Airlines.

3.2 React Native

Facebook 2015

Android, Android TV, iOS, macOS

React Native

Native React.

React Native

GitHub 90,5

3000

React Native,

QA

Stack Overflow.

React Native,

API. React Native

React Native

Javascript,

iOS

Android,

React Native

"Flux". Facebook

Flux

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- React Native

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- React Native

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- React Native

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- React Native Expo – React Native Framework, API- – (, push-);

- React Native - - , React Native. React

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- React Native –

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React Native.

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, React Native

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- , React Native,

JavaScript. Android

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JavaScript, Android. iOS, React Native, React Native ; React Native . Android iOS; iOS Android. , Udacity React Native, ; - React Native , Android. React Native Cross-Platform App Framework: Pinterest, Skype, Tesla, Wix, Uber Eats, Bloomberg.

3.3 Flutter

Flutter

Android, iOS. Google, Android Native Framework. 2021 Flutter , React Native . Flutter , GitHub 82,4 .

(React Native) 502 .
Flutter,
Flutter QA .
Google Flutter 2018
5 2018 ,
Flutter – ,
Flutter
, – Dart Code. C- ,
Javascript.
Hot reloading Flutter
MVP.
Flutter ,
Flutter
Flutter,
4 .
Flutter Reactive UI. RefluxJS Facebook
Flux Dart
Flutter-flux ,
StoreWatchers.
Flutter
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Hello World 6,7 . Flutter
 2,7 + , .
 Flutter .
 Android iOS. Flutter
 iOS —
 Android. 50 90%,
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 Flutter .
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 Android.
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 - hot reloading - ,
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 - Flutter
 , Google, GPS, '
 Bluetooth, , .

, Flutter ,

Dart ;

- MVP. ,

Flutter,

Android, iOS;

- Flutter , -

"Dart". ,

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- Flutter Google Material Design,

Apple – Cupertino;

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Android iOS,

, Travis Jenkins.

Flutter:

- Flutter Android TV Apple TV,

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- Flutter ,

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Flutter:

Google Ads, Alibaba, Tencent.

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3.4.1

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4

HTML JavaScript,
Ionic's Capacitor, Apache Cordova

HTML5 CSS3

. CSS3
. JavaScript (API)

GPS,

HTML5, CSS3 JavaScript.

Google Apple,

Ionic, Onsen Sencha Touch.

- , - . WebView
(),

4.1 Ionic

Ionic –

Drifty Co. 2013
Ionic 2014
Ionic Windows, iOS Android.
HTML5, JavaScript, Angular JS
CSS.
Angular, React, Cordova
Ionic Angular, Vue.js
React.js. Ionic.

VR-

3D-
Ionic
Ionic
BMW, Airbus,
NASA Apps, Ionic.

, , , SWORKIT, InstantPlot Shipt.
 Ionic - . Ionic
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 . , Ionic -
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 Ionic iOS Android Capacitor.
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 Ionic, WebView iOS Android.
 , Capacitor node.js,
 (,) React,
 Angular Vue.
 Ionic Framework .
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 - a SAAS,
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 Ionic:
 - AngularJS,
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 - Ionic .

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4.2 Sencha Touch

Sencha Touch –

HTML5, CSS3 JavaScript,

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Sencha Touch

MVC,

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MVC

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Sencha Touch

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Sencha Touch:

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Sencha Touch:

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Sencha Touch,

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- Sencha Touch

API- , Apache Cordova.

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4.3 Onsen

Onsen – HTML,

JavaScript, HTML CSS.

Angular 1, 2, React Vue.

Onsen

Onsen

Monaca.

Onsen UI, Monaca –

Cordova: Onsen UI

Cordova, , push- ,

Onsen:

Onsen ,

(, jQuery Angular).

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- Onsen ;
- « » ;
- Onsen:
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4.4

4.4.1

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- UI/UX.
- , (Android, iOS, Windows), . ,
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- . MVP
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Android iOS.

4.4.2

iOS Windows,

Android,

iOS.

Android,

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(PWA) –

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iOS Android.

PWA –

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HTML/CSS

JavaScript,

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App Store

Google Play.

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PWA

PWA –

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HTTPS:

HTTPS;

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PWA

- push- ;
- PWA ;
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- API: Twitter, Whatsapp
- Share API;
- Bluetooth API: , Apple Watch IOT, Bluetooth.
- SMS (, - , SMS)
- Bluetooth GPS , PWA
- PWA.
- JavaScript,
- (PWA)

HTML5

HTML5

CSS3

JavaScript.

API-

JavaScript,

API

API

API-

.API

API-

JavaScript,

API-

Notification-API

Push API

Service Worker API

- . JavaScript

API

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 PWA Lighthouse.
 - PWA,
 Google Chrome DevTools.
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 Lighthouse (0 100)
 / .
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 JavaScript
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 PWA.

5.1 Angular.JS

Angular.JS, 2010 Google,
 JavaScript.
 « » PWA.
 , Angular.JS 100%

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Apache 2.0.

Angular.JS

PWA.

JSON,

@angular/service-worker,

Angular.JS

Angular

Angular.JS

Angular.JS,

Ahead of Time,

Angular.JS HTML TypeScript

JavaScript

Angular.JS

Angular.JS,

, Angular.JS

Google.

Angular.JS:

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- « »;

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AOT.

AngularJS:

- TypeScript;

- SEO;

PWA, AngularJS: Corona Statistics,

Google Cloud.

5.2 React.JS

React.JS – JavaScript ,

Facebook 2013 . React.JS

- ,

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JavaScript, NextJS

GatsbyJS, ,

(), API .

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create-react-app.

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, AngularJS , .

, React.JS , AngularJS.

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    ,
-   ,
    React.JS,
-
    PWA.
    JSX          PWA
HTML.
    React.JS:
-   :          React.JS
    HTML;
-
    PWA;
-
    ,
-   ;
-
    ,
    DOM          ;
-
    ;
- React.JS          JS          API.
    React.JS:
-   React.JS          JSX,    JavaScript;
-   ;
-   SEO.
    PWA          React.JS: Starbucks, Twitter Lite.

```

5.3 Vue.JS

```

    React.JS    Angular.JS, Vue.JS
                JavaScript          PWA.

```

Angular.JS React.JS, Google Facebook,
Vue.JS

React.JS, Vue.JS

Virtual DOM

DOM.

- - HTML CSS,

, Vue.JS

React.JS

JavaScript.

React.JS

Vue.JS

MVP.

PWA.

, Vue.JS

- CLI3,

PWA

Vue.JS

Vue.JS:

- ;

- ;

- JSX Typescript ;

- Virtual DOM.

Vue.JS:

- Vue.JS;

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- PWA, Vue.JS: Zadig & Voltaire,
Tally Weiji.

5.4 PWA

Magento

« - » , -
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Magento, - ,
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PWA, , - .
PWA ,
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PWA - .
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Magento,
Google.
Magento 2.3 Magento PWA Studio.
Google Magento,
. , Magento

PWA.

Magento

PWA,

PWA.

« »

– PWA

5.5 PWA

5.5.1 PWA

PWA,

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- , PWA

PWA - Twitter, Microsoft Office, Uber, Forbes, Alibaba, New York Times, Pinterest

Google Microsoft PWA Android Windows

. Google ,
 , Chrome, PWA
 Google Play. Microsoft PWA
 Microsoft Store, ,
 . , PWA
 , ()
 Google Play, App Store
 Microsoft Store ,
 , PWA ,
 HTTPS .
 PWA ,
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 « » JavaScript ,
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5.5.2 PWA

PWA , :
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 - PWA ;
 - iOS.
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 PWA , ,
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PWA
 JavaScript,
 Kotlin Swift.
 JavaScript
 Bluetooth,
 Apple
 PWA iPhone,
 macOS. PWA
 iPhone iOS 11 2017
 iOS Safari, Safari
 PWA. Safari
 PWA 50 PWA
 iOS-
 App Store
 Safari, App Store.
 « », PWA
 PWA
 iOS iPhone
 PWA

Java, Kotlin, C#, JavaScript, HTML, CSS

Swift,

, PWA

1. Shaun Lewis, Mike Dunn. Native Mobile Development. – United States of America: O’Reilly Media, 2019.– 426 . – ISBN 139781492052876
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