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| **ASSIGNMENT SUBMISSION FORM** | | | |
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| Module Name | Fundamentals of Information Technologies | First Marker |  |
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| Module Leader | Olga Yugay | Agreed mark |  |
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# Introduction

We are contacted by mobile application development startup company. On behalf of IT consulting company, we must recommend best tools for mobile applications development. In this report, tools for project managers, developers, designers and testers will be reviewed, analyzed and will be divided into categories. The goal of this report is to discuss these tools, compare them with each other and also come up with one of the best solutions along with justification.

# Review of hardware and software solutions

## Software

In this part, a number of tools will be listed and evaluated according to type of users namely project managers, developers, designers and testers.

For project managers, Jira, Trello and GitHub, for mobile application developers, Android studio, XCode and Visual Studio, for designing and prototyping part of mobile applications, Adobe Photoshop, Adobe XD and Canva, for testing Appium and Selendroid are suggested.

## Hardware

When it comes to computers, there are mainly to two types of computers for the team, namely Windows PCs and MAC laptops. Windows PCs can be built manually collecting and customizing necessary parts and also there are ready to use versions. However, you cannot customize MAC laptops configuration. More details on their price, configuration info, benefits and limitations are given in the hardware tools’ table.

As far as servers are considered, they are connectors of all the building blocks in the process of building an application and provide tools to manage your storages as well as environment to run your application. Currently, cloud-based servers are most popular among other types of servers as it is not expensive, which can provide more tools and functionalities. Therefore, what we suggest in the review is Amazon Web Service (AWS) server provider. While developing a mobile application, cloud storage, integrated development environment (IDE) and software development kit and tools (SDK) for mobile development will be purchased and installed. Thus, in the table and justification parts below more details are provided.

## List of solutions in table

### Software

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| --- | --- | --- | --- | --- |
| Name and price | OS support | Brief description | Benefits | Limitations |
| Project management tools | | | | |
| Atlassian, Trello  Price:  Main: Free  Gold: $45 /year  Annual Business plan: $9.99 /month | Cloud-hosted  SaaS solution  Browser support:  Chrome, Safari, Firefox, Edge | Trello is lightweight cloud-based project management tool which is mainly designed for general use.  Built by Atlassian | Quite cheaper among Project management tools.    Trello free offers unlimited boards, lists and cards, no restriction on number of members in a team. Differences between memberships is allowed attached file size and security levels.  Provides  Resource management, task management, document management, board views, card views | No reporting and charts  No time tracking  No issue management  Only cloud-hosted |
| GitHub  Public projects: Free  Developer plan: $7 /month  Team plan: $9 / user/ month  Business plan: $21 / month | Cloud based  SaaS solution  Browser support:  Chrome, Microsoft edge, Mozilla, Firefox, Safari | Open source code management system,  Cloud-based version control and collaboration platform for software developers | Provides integrated issue tracking features  Over 200 programming languages are supported.  Excellent version control, backup and collaboration system  Zen mode writing experience and auto completer | Hackers target GitHub |
| Atlassian, Jira software  Price: $100 /year | Cloud based and On-premises  SaaS solution  Browser support:  Chrome, Firefox, Safari, Internet explorer, Mozilla | Jira platform helps teams to plan, assign tasks, manage process and report issues.  Jira is mainly designed for software teams.  Built by Atlassian | Excellent project planning and issue tracking feature  Provides various dashboards and overviews for agile project management.  Provides:  Resource management, task management, document management, board views, card views, reporting and charts, time tracking, issue management.  Both on-premise and cloud-hosted versions available | History of changes are not supported  Issue of deletion (if an issue which has been downloaded is deleted, it will still remain in Jira client)  You cannot search text by relevance, Jira client will search by exact words. |

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| Development tools | | | | |
| Android studio 3.5  Price: Free / Open  source | Windows/ Mac/ Linux/ Mac OS/ Chrome Operating system | Official integrated development environment (IDE) for android applications, developed by JetBrains.  System requirements:  RAM: minimum 4GB recommended 8GB  Screen resolution: minimum 1280 x 800  Available disc space: recommended 4GB (0.5 GB for IDE and 1.5 GB for Android SDK and emulator system)  (if Windows) 64-bit recommended | It is easy to edit application layouts.  Intelligent Code Editor equipped with IntelliJ IDEA interface to code easier and faster.  Makes easier to bring changes to an existing application.  Google platforms support well. | Requires a lot of memory in RAM.  iBus daemon on Linux may interact with android studio. In some cases, it may result in IDE stops.  When using Platform Tools 29.0.3, native debugging and Android Studio Profilers may fail to work as expected. |
| XCode 11  Price: Free for Mac OS | Mac OS | IDE software for platforms Mac OS, iOS, watches and TVOS, developed by Apple corporation | Fast and easy coding assistant  Easy and smooth navigation through your project  Easily test your app while you build it in an environment that your iPhone has  Provides a lot of number of schemes features for your task. | Only works for Mac OS. |
| Visual Studio App Center 2019  Piece:  Community: Free  Professional: $45 / month | Windows / Mac OS / Linux | Needs Hyper-V support  6GB RAM (recommended)  64-bit version of Windows 8 or higher  Needs a processor which supports SSSE3 or higher  It supports Visual Studio Emulator for Android.  Developed by Microsoft team | Easy to deploy your apps with Microsoft Azure App service which is Platform as a service (PaaS).  Able to build cross platform apps  Excellent diagnostic and testing features (400 unique device configurations available) | Does not support vibration control  No compass tests  No gyroscope and proximity test |
| Designing and prototyping tools | | | | |
| Adobe Photoshop  Price:  Monthly plan:  $31.49 / month  Annual plan, prepaid:  $239.88 /month  Annual plan, monthly payment:  $20.99 / month | Windows, MacOS | Adobe product  Image editing software solution and mainly used by professional photographer and graphic designers  Provides:  100 GB cloud storage  Access to new releases and Adobe Portfolio, Adobe Fonts and Adobe Spark | Offline solution  Various design tools with responsive design  Able to edit video and animation layers  Able to edit all types of images without expensive plugins  Files can be easily transferred between various programs | High price  Not all the functionalities will be used.  Less support for vector graphics  Progress monitoring facility is not available  Sometimes untested versions are released |
| Adobe XD  Price:  Starter Plan: Free  XD single app: $9.99 / month  Creative cloud all apps: $52.99 /month | MacOS, Windows | Adobe product  System requirements:  RAM: 4GB (recommended)  Screen resolution: 1280 x 800 (minimum) | Easy to use for UI/UX designers  Prototyping features:  1. No extra plugin/services needed  2. Previewing prototype in separate window | Cannot export from CSS  Animating UI is difficult, cannot import files from Sketch  Difficult to design customized shapes  only Mac OS works to see prototyping live of smartphones on real devices. |
| Canva  Price:  Basic: free  Pro: $12.95/month | Cloud based  SaaS solution  Browser Support:  Microsoft  Chrome, Internet Explorer, Mozilla Firefox, Safari | Canva is one of the most popular cloud based designing and prototyping tool.  It was founded by Melanie Perkins in 2007 | Supports team collaboration  Keeps your project organized  Really user friendly with drag and drop functionality  No storage limit | No internet, no Canva  High pricing |
| Testing tools | | | | |
| Appium  Price: Open source/Free | MacOS, Windows and Linux | Automated mobile application testing framework for IOS and Android  Developed by Dan Cuellar in 2011  Won the 2014 Bessie award of InfoWorld being the best open source desktop/mobile software  Based on Selenium  Sponsored by Sauce Labs | Strong and active open source  Support for testing in multiple developing languages  Supports JSON wire protocol  Provides cross-platform solutions for native and hybrid apps  Does not require to recompile the code  Both Android and IOS apps can be tested | Slow test execution  Androids lower than 4.2 cannot be tested  Hybrid apps testing support is limited  Poor image recognition |
| Selendroid  Price: Open source/Free | Windows, Mac OS, Linux | Test automation framework for Android native and hybrid apps  Used the Selenium 2 client API to write testing | Full compatibility with JSON Wire Protocol/Selenium Ready 3  Can interact with multiple Android devices  Advanced user interactions API  Existing emulators start automatically  Simplified test case development by building in Inspector  Automation does not require app modification under test | Quite slow testing process  Tests only Android apps  Machines with less than 4GB RAM hardly can use Selendroid |

### Hardware

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| Name and price | OS support | Brief description | Benefits | Limitations |
| Windows PC  Overall estimated  Price: $720  (Tax, delivery not included)  (Amazon price) | Windows | Optimal windows  Recommended by freecodecamp.org  PC config:  Intel Core I7 processor 8th Gen  16GB RAM  CPU 2Ghz  1 Terabyte Hard Drive  Monitor:  Aspect ratio: 2.35:1  Display resolution max: 3440 x 1440 pixels  Display Size: 34 in  Item Dimensions: 32.7 x 9.5 x 18.1 in | This is optimal general configuration for mobile application development team. | However, this can be optimized based on types of users. Namely, some users may need more features while some of the features may not be used fully by some users, which means these features can be removed or reduced to overcome high price. |
| IOS Laptop  MacBook pro (recommended)  Price: $1799  (tax, delivery not included)  (Apple price) | Mac OS | MacBook configuration: (recommended by www.macworld.co.uk) 2.4GHz Quad-Core 8th-generation Intel Core i5 Processor (up to 4.1GHz) 256 GB storage  8GB 2133MHz LPDDR3 RAM memory  Intel Iris Plus Graphics 655 | Supports Swift software application to build mobile applications for IOS.  Supports almost all software solutions. | High price |

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| --- | --- | --- | --- | --- |
| Name and price | OS support | Brief description | Benefits | Limitations |
| Cloud based server | | | | |
| Amazon Web Service  Pricing: Pay for what you use | Windows, Linux  PaaS solution | One of the leading cloud platforms in the world.  Provides a lot of services like  [compute](https://aws.amazon.com/products/compute/), [storage](https://aws.amazon.com/products/storage/), [databases](https://aws.amazon.com/products/databases/), [analytics](https://aws.amazon.com/products/analytics/), [networking](https://aws.amazon.com/products/networking/), [mobile](https://aws.amazon.com/mobile/), [developer tools](https://aws.amazon.com/products/developer-tools/), [management tools](https://aws.amazon.com/products/management/), [IoT](https://aws.amazon.com/iot/), [security](https://aws.amazon.com/products/security/) and [enterprise applications](https://aws.amazon.com/enterprise/). | It is cost-effective as you pay for what you use.  It is so flexible that you can select operating system, programming language, web application platform, database, and other services you need and AWS provides a virtual environment with necessary tools and services that your application needs.  Your application is scalable with AWS tools like Auto scaling and Elastic Load balancing which scale up or down according to the demand to your application. | As off-premise storage solutions are internet based, access is completely depending on Internet connection.  If you decide to cut cost by not upgrading faster software, speed can be problem. |

# Justification and recommendation

## Hardware

For hardware computers Windows PC and IOS laptop, MacBook pro is recommended. Windows PCs’ cost in Amazon is $720. FreeCodeCamp.org recommends most optimal windows as follows: Intel Core i7, processor 8th generation, 16GB RAM, CPU 2Ghz, 1 Terabyte Hard Drive, 2.35:1 aspect ratio, 3440 x 1440 pixels, 34 in display size and 32.7 x 9.5 x 18.1 in item dimensions. Windows PC such configuration is optimal for mobile applications development.

Next, MacBook pro iOS laptop is recommended for its outstanding configurations. This laptop supports Swift software application for building iOS mobile applications and supports almost all software tools. The only disadvantage of this laptop is its high price.

Afterall, Windows PC is recommended as it is the most optimal for development team in terms of price and customizable configuration.

Amazon Web cloud-based server is also recommended, which supports Windows and Linux PaaS solution. Amazon Web will be paid for what is used. Amazon Web is one of the leading cloud services in the world, which provides lots of services such as storage, databases, analytics, networking, developer and management tools, security and enterprise applications. However, Amazon Web is completely dependent on Internet connection, not upgrading faster software can create problem in speed.

## Software

### Project Management tools

Trello (SaaS solution by Atlassian) is designed for general use and is very flexible cloud-based software for organizing team tasks. With the help of Trello - cards, comments, attachments, deadlines can be added to ease team work. Trello main is free and open to use, gold membership is $45 per year and is quite cheap compared to other project management tools. Trello provides unlimited number of cards and team members, also provides resource, document and task management operations. One of the desirable features of Trello is its notifications, Trello notifies if a task is removed or commented. Disadvantages of Trello are that it does not provide charts, reporting, time tracking, editing cards, issue management and storage limit for basic users. Trello is only cloud based, by which if there will not be internet connection, Trello cannot be reached.

Next development tool is Jira, also developed by Atlassian, which supports Firefox, Safari, Internet explorer, Chrome and Mozilla. Advantages of Jira are that it tracks issues and time, provides various dashboards, excellent management features and both on-premises and cloud-based versions are available. Not having history of changes, deleting problems (problem cannot be deleted from Jira client) and not efficient searching features (exact words must be searched, no key words will give result) are the only disadvantages of Jira. Yearly fee for the Jira is $100, basic is free, standard costs $7 and premium membership costs $14 for a month.

One of the most widely used tools by developers is GitHub (SaaS), storing over 80 million source code (Kumar, 2018). It does not require a monthly fee for public projects, however special planning (developer, team and business) ranges from $7 to $21 for a month. GitHub supports over 200 programming languages, version control, back up of the work, excellent system for collaboration and issue tracking. Developers mostly love the feature of Zen mode and auto completer. Afterall, GitHub recommended for project management tool for mobile application developers. Developers say, the only disadvantage of the GitHub is its security from hackers, as hackers mostly target GitHub for it is being the biggest storage of source code. However, GitHub claims having a strong security protection from hackers and probability of being hacked is very low though after Linux distro hacked, they have strengthened their protection level more.

To conclude, for the project management GitHub is recommended because of its some advantages such as programming language support, price and features over Trello and Jira.

### Development tools

Android Studio 3.5 developed by JetBrains, which supports widely used operating systems and requires at least 4GB, while 8GB is recommended. Android studio 3.5 is easy to use and edit because of IntelliJ IDEA interface. Ready applications easily can be changed in the Android Studio 3.5, Google platforms supported well. However, the Android Studio 3.5 requires a lot of memory, sometimes iBus daemon on Linux and the app interaction may result in IDE stops. Sometimes native debugging might fail unconsciously.

XCode 11 is the next development tool for mobile applications, which supports Mac OS developed by Apple corporation. It is fast and is one of the easy to use tools, also easily can be tested. XCode 11 provides wide range of features for easy mobile applications development of iOS. The only downward of this tool is that it works only for Mac OS.

Another development tool is Visual Studio, which supports Windows, Mac OS and Linux. Easily can be used as PaaS with Microsoft Azure service. Visual Studio enables to build cross platform apps with the help of Xamarin and React Native programming languages, which is not supported in XCode 11. Visual Studio has excellent debugging features and 400 unique device configurations.

To conclude, Android Studio 3.5 is recommended for mobile applications development as it has wide range of availability for almost all operating system. Moreover, with the help of Android Studio not only android apps but also cross-platform applications can be produced. Therefore, this really comes in handy for the startup of mobile applications development.

### Designing and prototyping tools

Adobe Photoshop, Adobe XD and Canva is chosen as competitive designing tools. Adobe Photoshop is a image editing app, mostly used by photographers and graphic designer, which provides 100 GB cloud storage. Adobe Photoshop costs from $20.99 to $31.49. With Adobe Photoshop a designer can have access to several services delivered by Adobe including Portfolio, Fonts and Spark. There are ample of pros of Adobe Photoshop, such as available offline solution, absence of Internet will not be a problem, various design tools, ability to edit animations and videos, files can be transferred easily between various programs. Disadvantages of Adobe photoshop are high price, not all of the functionalities will be used, less support for vector graphics, sometimes not tested versions will be released.

Adobe XD is the next recommended tool, which supports Mac OS and Windows. XD single app costs $9.99 for a month. Adobe XD is easy to use for UI/UX designers, does not require additional services and previewing prototype in separate window is available. Disadvantages are that CSS files cannot be exported, animating UI is difficult, cannot import files from Sketch, for testing it requires iOS mobile phones.

Canva is a popular prototyping and designing cloud-based SaaS solution, founded by Melanie Perkins in 2007. Basic membership is free and pro membership costs $12.95 for a month. Canva supports team collaboration, keeps projects organized, user friendly, has various useful tools and has no storage limit. Disadvantages of Canva are that it cannot be used if there is no internet and its pricing is a bit high.

For the mobile applications start-up, Adobe XD recommended as it has more useful tools for UI/UX designing which is useful for designing mobile applications.

### Testing tools

Appium is a open source, automated mobile applications testing framework for IOS and Android. Advantages of Appium are being a strong open source, support of multiple developing languages, supports JSON wire protocol, cross-platform solutions, does not require to recompile the code. Disadvantages are hybrid apps testing support is limited, Androids lower than 4.2 cannot be tested, poor image recognition and slow test execution.

Selendroid is another open source framework for testing cross-platform apps. Advantages are support of JSON wire protocol, interaction with multiple Android devices and advanced user interactions. Selendroid is also known by its comfortable testing conditions, can be integrated as a node into the Selenium Grid for parallel testing. Downwards are slow testing, can test only android apps and requires more memory to run.

Appium is the most suitable testing tool for mobile applications as it can test both, IOS and Android apps in any programming language.

# Conclusion

In order to equip mobile applications developing start up, wide range of tools are recommended along with justification. As basic needs of the development process, first hardware is chosen to be Windows PC with special recommendation of its configuration. Additionally, Amazon Web service is recommended, which offers wide range of services. Next, GitHub for project management, Android Studio for development and Adobe XD is highly recommended for designing. Above mentioned tools are chosen not only for its outstanding features, but also its suitability for mobile application development.

Google Document link: [https://docs.google.com/document/d/1uutmibhOOwcEH6U4OTkk-vKe0eH\_-DGgEmA27bb7cOA/edit?ts=5e467174#](https://docs.google.com/document/d/1uutmibhOOwcEH6U4OTkk-vKe0eH_-DGgEmA27bb7cOA/edit?ts=5e467174)

GitHub link: <https://github.com/WIUT-FIT-cw1/FIT_7510_7912>

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