



# **Technology Consulting in the Community**

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**Spring 2018**

**Bobson Rugambwa  
Smart Futures  
Final Consulting Report**

**Carnegie Mellon University  
Pittsburgh, Pennsylvania  
[www.cmu.edu/tcinc](http://www.cmu.edu/tcinc)**

**Carnegie Mellon University**

# SMARTFUTURES

## Context Analysis

Student Consultant, Bobson Rugambwa  
Community Partner, David Mosey

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### I. About the Organization

Smart Futures is a non-profit organization registered in Pittsburgh in the state of Pennsylvania. The organization's programs are geared towards equipping young people going through the school system in Pennsylvania with the necessary tools to "get real about whom they are, where they are and how to get there".

The organization was founded in 2005. They use technology (web applications) as a means of delivering the tools that they have custom designed to enable them meet their mission, which is;

*To provide Pennsylvania's educators with innovative resources that help students "get real" – about who they are, where they are going and how to get there.*

### II. Developing a Technology Plan for Smart Futures

To support Smart Future's expansion drive, there was a need for a strategic technology plan. For Smart Futures to successfully expand its user base, they are going to need a fully functional, solid platform, as well as clear cut internal processes to support this growth. The plan will define the key deliverables on platform improvements, infrastructure, team composition, tools, security and privacy considerations, and system architecture for the platform, among other key things.

### III. Outcomes

A comprehensive strategic technology plan has been developed for the organization. The plan will now guide the next phase of changes in operations and development at the organization as they seek to achieve their medium-term goals. If well implemented, the plan will help the organization serve more clients on their platform without incurring extra costs on hosting as a result of optimization done on the hosting.

### IV. Recommendations

The next three years for Smart Futures should be defined with steady growth in the number of users towards the thirty percent market share target, through the provision of the most robust end-to-end career planning, skills development and reporting platform in the state of Pennsylvania, while at the same time being able to provide support for the growing number of clientele.

For this vision to be attained, there are key changes and investment that Smart Futures will have to make to its platform as well as in its operations and workforce to ready itself as well as be able to sustain the growth once it starts.

As a result, some of the key recommendations towards achieving this vision are;

- Decoupling of the billing system from the college and career readiness platform
- Use of a separate test and production server
- Use Version Control, Continuous Integration & Continuous Deployment (CI&CD)
- Implement a Support Ticketing platform

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**Community Partner**

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**About the Consultant**

Bobson Rugambwa  
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Bobson is a graduate student in Information Technology at Carnegie Mellon University Africa. He will begin working as a CTO at Mvend Limited where he is also the co-founder in the summer.

## **I. About the Organization**

### **Organization**

Smart Futures is a non-profit organization registered in Pittsburgh in the state of Pennsylvania. The organization's programs are geared towards equipping young people going through the school system in Pennsylvania with the necessary tools to "get real about whom they are, where they are and how to get there".

The organization was founded in 2005. They use technology (web applications) as a means of delivering the tools that they have custom designed to enable them meet their mission, which is;

*To provide Pennsylvania's educators with innovative resources that help students "get real" – about who they are, where they are going and how to get there.*

The organization is currently looking at scaling their operations in terms of number of users having recently completed their smartfutures.org platform. This provides an opportunity and a challenge. Whereas more users will mean growth of revenue, there is need to be able to support the growing numbers in an affordable manner through scalable cloud hosting. Also, they will need to greatly expand their support function, as the new schools will need short turn-around on queries. Currently there is no defined client support system or support ticket platform. Currently, there are 60 schools and over six thousand active users using these platforms.

### **Facilities**

Smart Futures works out of a co-working space by Ascender on 6401 Penn Avenue. Their offices are neat and bright. The office space has seating for up to six people, with three desktop computers.

The walls are adorned with work charts containing information about projects and strategy.

Ascender, according to its website, is a hub for Pittsburgh's starters and builders, providing programming, insight, and connectivity.

### **Programs**

Previously, the organization run three different programs, Keys2Work – A skills development platform that helps students develop skills in various areas of their career interests, My Career Journey – an application that helps students plan out their career journey and eMentorship – an online platform that links students to mentors. They are currently in the process of phasing out the old platforms they had and bringing all the services under the smartfutures.org platform.

This platform has an embedded career planning tool, a skills development tool and an e-mentoring platform. This platform supports the mission by providing the tools that

enable the students to do career planning, skills development and mentorship. Each student in a school that uses this platform would have an account where progress on career planning, and skills development can be tracked and reports with supporting artefacts generated.

The student would also have access to a mentors feature. This feature enables students to find and communicate to mentors who support them on their career development journey.

The state of pennsylvania now requires schools to provide annual reporting on the progress of students with respect to the “Every Student Succeeds Act”. The organization hopes to be able to provide a tool for the schools to meet this requirement through the new smartfutures.org platform.

## **Staff**

The organization currently has one full time employee, Mr. David Mosey who is the founder and Executive Director of the organization. They also have an application developer working remotely, and a part time administrative assistant. The organization has a board of directors.

Executive Director – David Mosey. He is the brain behind the operations of the organizations. A former educator and salesman, David is responsible for the day to day running of Smart Futures and mans its offices. He is my primary contact person for this project. David uses an iPad as well as one of the desktop computers at the office.

Sara Singh – Developer. She is the person responsible for making the “platform dreams” a reality. She takes all the requirements developed by Mr. Mosey and turns them into platform functionality. She works remotely from India. She has access to the servers both in the cloud and locally at Smart Futures offices.

## **Technology Infrastructure**

Smart Futures uses cloud-hosting services provided by Verio/NTTA for their website and application. They also have a server that contains their databases. The server uses Windows Server operating system.

There are an additional three desktop computers that are used in the office. Both of them are running on windows 7 operating system.

There is a wireless Internet connection at the office location provided by Ascender. This however presents a challenge as the different people that are hosted at the hub as well as guests share the Internet connection.

It would thus be advisable to move their entire platform related infrastructure into the cloud. This would significantly improve the security as well speeds of their platform.

## **Technology Management**

Mr. Mosey, the Executive Director is responsible for all technology decisions at the organization. He handles the decisions on the platform, what features to add, and when

to add them. He also is responsible for collecting feedback from the users and sharing it with the developer for the required changes. He also provides end user support.

The technical team is currently composed of Mr. Mosey and Miss Singh, the developer who works remotely from India.

### **Technology Planning**

Mr. Mosey is responsible for the technology planning at the organization. He handles all the planning and decision making on features to add the platform, when they are added, and the technologies used. The organization currently has no technology plan.

### **Internal and External Communication**

Communication is by email and chat. When contacting the developer, Mr. Mosey uses *WhatsApp*. The organization's social media sites are currently inactive.

Additionally, information about the organization can be found on their website (<https://smartfutures.org/site/about/>)

### **Information Management**

Currently, all code of the platform is stored on the deployment server. The organization has no test servers and uses the production server for testing. They also do not use any version control tool. The backup of this code is on the developer's machine and another copy on is kept on a desktop in the office.

Their applications use MS SQL server 2012. The databases have been aggregated to a certain level to support all their applications.

### **Business Systems**

Currently the organization has no support ticketing system or billing system, but they are looking at possible implementation/acquisition of the same. They hope that the technical plan to be developed can provide guidelines on how to handle the process.

## **II. Developing a Technology Plan for Smart Futures**

### **Motivation**

Smart Futures plans to begin an expansion drive in September 2018. This plan that will run through to September 2020, is aimed at capturing at least 30% school districts market share in the state of Pennsylvania. This will require various changes, modifications and adaptations of their platforms, infrastructure, technical, support and billing processes in order to be able to support this growth while maintaining the level of fast turn-around in support and reliability that their already existent customers are already used to.

It is therefore of paramount importance that a technologies plan be in place before the expansion drive starts. The plan will define the key deliverables on platform improvements, infrastructure, team composition, tools, security and privacy considerations, and system architecture for the platform, among other key things. It will also include guidelines on some business processes for the technology department.

Currently, Mr. Mosey makes all technology decisions. However, as the expansion drive begins, he will have to focus on other key areas such as funding, training, and administration among others. The absence of a clear plan guiding what, how and when things need to be done would be detrimental to the success of the drive. This could lead to loss of time, money and client confidence.

The absence of a technology plan would mean that decisions would have to wait for the availability of David. This could significantly hamper progress and hurt the prospects of achieving the set goal.

To ensure that the vision is sustained, I will work with David to capture his ideas, and decision process and create a set of guidelines that would be useful for the supporting technical team. That way, even ahead of time, these key decisions are made. The team that will be recruited as a result of this plan will handle the ad-hoc decisions.

A comprehensive strategic technology plan has been developed for the organization. The plan will now guide the next phase of changes in operations and development at the organization as they seek to achieve their medium-term goals. If well implemented, the plan will help the organization serve more clients on their platform without incurring extra costs on hosting as a result of optimization done on the hosting.

## **Outcomes**

### **Developing an Organizational Technical Plan**

I talked to the client to understand the various internal organizational processes to be able to identify the bottlenecks and the organization had and why they felt these were key areas that needed to be looked into.

As a result, we were able to identify the key areas that needed to be planned for in line with the medium-term growth goals of the organization. We then grouped the areas into categories under two key functions in the organization, which are sales and marketing and technology for easy planning. We also classified the areas of concern that the client had raised into these main planning boxes.

## **Technology**

We identified two key areas in technology; the application development process and the application hosting.

### **Application Development Processes**

We reviewed the application development process to identify key components that were missing and found that there were no version control tools being used by the developer. This presents a key challenge in rolling back or tracking changes. Use cases added to the system were not documented as such there didn't exist any documentation on requirements or business rules for the various use cases. The architecture of the system is also not documented.

The production database also included some temporary tables that were used for testing or supported functionality that was no longer in use. Coupled with lack of proper indexing on the database tables, it is difficult to optimize performance on the database.

We also discovered that the current application stores passwords as plaintext in order to facilitate password recovery through the instructor account which poses a serious security/privacy risk.

## **Cloud Hosting**

The team uses one cloud hosting server which acts both as the production and test server. This server also acts as the application and database server. This we found was a big challenge in two major ways; There was a risk of test code ending up in the production environment and breaking the system especially if the code had not yet been sufficiently tested and using the same server for the application and database posed a security risk.

## **Sales & Support**

### **Ticketing & Customer Support**

We identified that whereas David is able to support the current active clients by phone and email, the organization was not keeping track of the issues that clients raised, or how they had been resolved. This meant that issues reoccurring took the same time to resolve as the first incident of the same due to lack of records. The organization also did not have a knowledgebase that can be used to support the resolution of tickets/support queries and would in the long run not be able to enable client self-help on their platform.

We also realized that as the number of clients grew, it would become increasingly difficult to for David to provide support to all of them, in good time and still be able to do his other administrative responsibilities. It would also be impossible to measure query response/resolution time in the absence of a mechanism of tracking support tickets.

## **Billing & Licensing**

We were able to identify two challenges in billing and licensing namely, the old technology in which the current billing platform was developed, as well as its interface with the smart futures platform and how licenses are applied to client accounts.



Smart Futures business/licensing model is also changing to include the ability to sell licenses to school districts rather than school buildings. A base number of buildings would be included in the primary license, with additional payments being made for additional buildings. This meant that since the district would be paying, all beneficiaries would share the same license. The current approach of manually applying licenses would therefore be unsustainable, and we found that a safer, quicker approach would be required. The current billing platform, being built on Adobe flash and with support for the technology by Adobe and most browsers being phased out, improvements to this platform would not be possible.

The sustainability of this plan will be dependent on the availability of financial resources specially to hire critical people with the right skill sets to oversee its implementation. In the absence of some of these resources, key personnel, and tools may not be acquired. This would put certain key elements of the technical plan in limbo.

The plan will now guide the next phase of changes in operations and development at the organization as they seek to achieve their medium-term goals. If well implemented, the plan will help the organization serve more clients on their platform without incurring extra costs on hosting as a result of optimization done on the hosting.

Other than the stated direct benefits to the technology department, the technical plan will also be key in making decisions on staff hires and required skillsets. By identifying key tasks to be performed, and giving a timeline, it becomes easy to decide on the kind of people required and whether they can be short term or long term hires.

Further still, the plan will be useful for budget/financial planning as it points to key tasks, and times when spending will happen. This thus can be useful in budgeting as well as fundraising.

### **III. Recommendations**

#### **Vision**

The next three years for Smart Futures should be defined with steady growth in the number of users towards the thirty percent market share target, through the provision of the most robust end-to-end career planning, skills development and reporting platform in the state of Pennsylvania, while at the same time being able to provide support for the growing number of clientele.

For this vision to be attained, there are key changes and investment that Smart Futures will have to make to its platform as well as in its operations and workforce to ready itself as well as be able to sustain the growth once it starts.

#### **Decouple Platforms**

##### a) Introduction

Currently all their billing platform database is part of their smart futures application database. This increases their cloud hosting bill given the amount of resources they consume. This is however unnecessary as the smart futures application would run without the billing application database tables.

#### b) Motivation

There are overheads to having an unnecessarily bulky database. These overheads come both in terms of the bills paid for the cloud hosting as well as the performance of the application. This eventually affects the overall user experience while costing the organization money. The overall motivation of decoupling therefore would be to optimize the performance of the Smart Futures platform and get an overall better user experience while reducing the hosting expenses.

#### c) Strategies

For this to be possible, the following can be done.

- Change the Smart Futures platform to require only a license code and expiry date attached to each account for verification.
- Provide an API end point for billing to apply a license to a client's account on the Smart Future's platform
- Remove all database tables for the billing platform from the Smart Futures platform and any dependencies in the code.
- Deploy a separate billing platform that can be integrated via a RESTful API to the Smart Futures platform providing licensing information

#### d) Expected Outcomes

The expected outcomes are two-fold;

A lighter database and fewer queries reducing the resource usage of the platform thus saving on the cloud hosting costs. Further still, the lighter system and fewer queries will improve the response time and page load times of the Smart Futures platform at login when checking for a valid user license.

## **Use a separate Test & Production Server**

#### a) Introduction

Development and testing all happen on the same server, share a database (with only a differentiation of tables for certain functions). This is very risky as it can compromise the application if unapproved or unready code is added to production leading to extended downtime.

#### b) Motivation

As the number of users on the platform increase, there will be requests for features as well as bugs that will become evident only as people use the platform more and more. These users will also expect that the platform is up and working properly at all times. It would be disastrous therefore if the platform were to go down due to tests being carried out on the production server or production unready code ending up in the production folder. This not only becomes an inconvenience for the user, but it can also be a security risk.

### c) Strategies

The following actions are required to realize this goal;

- Procure and set up a new platform for the test environment. This should be a similar environment as the production server, but with less resources.
- Create the last best version of the production platform onto this server as the starting point for future developments/improvements
- Clean up the production server of any files, databases, libraries that are for the test instance of the platform.
- Run tests on the production environment application to ensure that it works well.

### d) Expected Outcomes

Once this is implemented, it is expected that all resources on the current production server that is being used for both test and production will be dedicated to the live environment. It will also reduce the likelihood of an unplanned deployment of testbed code into the production environment. It could in the short time reduce the overall cost of hosting by cutting back on the required resources to only those needed to support the current user base.

## **Use Version Control, Continuous Integration & Continuous Deployment (CI&CD)**

### a) Introduction

In order to meet the fast turnaround for new features, while at the same time having the ability to roll back, a version control tool is highly recommended. This should be coupled with tools for CI&CD to ensure that new features can be easily added to the platform, with minimum risk of failure as CI will ensure that the new features will not break the platform

### b) Motivation

With the anticipated growth, requests for new features, bug fixes, and general upgrades will increase. This will eventually lead to growth of the number of developers and in some cases require remote working. Also, once features or bug fixes have been tested sufficiently, they will need to be seamlessly added to the platform. Thus, having a version control tool to support the increased number of developers, track changes, ease roll-back in case of issues among other advantages becomes paramount. Furthermore, adding CI&CD tools will ensure that once changes have been made and tested, they can seamlessly be integrated into the production environment.

### c) Strategies

To realize this goal, we will need to act on the following;

- Identify a suitable version control tool and adopt it.
- Procure a paid, private account since the code stored there is proprietary to Smart Futures Inc.
- Move the latest code base into the repository on the version control tool
- Procure CI&CD tools/licenses for the repository and link them
- Develop a collaboration guide and standard for the development team

- Add developers to the organizational account once they have gone through a training on the collaboration standard.

#### d) Expected Outcomes

The expected outcome of this would be improved productivity of the development team, ease of increasing developers and ability for a bigger team to work remotely, as well as ease of testing, integrating and deploying new features, fixing bugs and general improvements to the platform.

## **Implement a Support Ticketing platform**

### a) Introduction

Currently, all support requests are either by email or telephone calls. This means that there is no clear documentation of the processes used to resolve the support issues, or even whether they have been resolved. Also, all the support requests resolution is handled by one person. The implementation of a support ticketing platform will therefore create a central place where all support tickets can be handled.

### b) Motivation

Given the anticipated growth, it would be helpful to implement a support ticketing system. This ensures that all support requests can be tracked, and no client request is dropped or lost. Also keeping a record of issues and how they were resolved, it makes it easier in future to resolve recurring issues in a short time. Information collected here eventually becomes part of the knowledge base that can be available on their website for users to self-support.

### c) Strategies

To achieve this goal, the following steps need to be acted on;

- Identify a support ticketing platform, possibly one that is part of a CRM
- Procure and set it up.
- Develop a guide that specifies classification of the expected queries and a process for handling each.
- Train the team members that deal with clients (Support & Sales) on the platform and the guide.
- Create a support ticket form on the Smart Futures platform through which users can submit their tickets.
- Inform users of the new feature on the platform so that they can start using it
- With the long-term goal of creating a knowledgebase, ensure that queries are properly classified, and resolution details are entered for each ticket handled.

### d) Expected Outcomes

The key outcome of this goal will be sufficient queries and answers that can be turned into a knowledgebase that enables users to easily resolve their issues without constantly contacting support. Other outcomes would be a faster resolution of support tickets, an ability to measure the effectiveness and efficiency of the support team.

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### **About the Consultant**

Bobson Rugambwa is a graduate student in Information Technology at Carnegie Mellon University Africa. He will be graduating from the program in May 2018. Bobson will then resume work as the Chief Technology Officer at MVendor Limited, where he is also a cofounder. MVendor is a fintech company in Rwanda offering digital payment solutions and mobile banking solutions for the underserved.

# SMARTFUTURES

## Strategic Technology Plan

May.11.2018

**1. Introduction**

**1.1. Organization Mission:**

*To provide Pennsylvania’s educators with innovative resources that help students “get real” – about who they are, where they are going and how to get there.*

**1.2. Organization Description:**

Smart Futures is a non-profit organization registered in Pittsburgh in the state of Pennsylvania. The organization’s programs are geared towards equipping young people going through the school system in Pennsylvania with the necessary tools to “get real about whom they are, where they are and how to get there”.

The organization was founded in 2005. They use technology (web applications) as a means of delivering the tools that they have custom designed to enable them meet their mission.

The organization is currently looking at scaling their operations in terms of number of users having recently completed their smartfutures.org platform. This provides an opportunity and a challenge.

Whereas more users will mean growth of revenue, there is need to be able to support the growing numbers in an affordable manner through scalable cloud hosting. Also, they will need to greatly expand their support function, as the new schools will need short turn-around on queries. Currently there is no defined client support system or support ticket platform. Currently, there are 60 schools and over six thousand active users using these platforms.

**1.3. Technology Planning Team:**

Record information about each person who contributed to the content of the document.

Name	Title	Email	Role on Team
David Mosey	Chief Executive Officer	dmosey@smartfutures.org	Lead
Sara Singh	Developer	moooon385@gmail.com	Member
Bobson Rugambwa	Consultant	brugambwa@gmail.com	Consultant

## **2. Organization Analysis**

### **2.1. Current Business Processes:**

There are three key processes that are covered by this technology plan. These were identified while working with the client and agreed upon as the key areas that need to be studied and planned for in order to meet the medium-term goals of the organization. The current state of these three areas is given below;

#### **2.1.1. Application Development, Testing & Deployment Processes**

We reviewed the application development process to identify key components that were missing and found that there were no version control tools being used by the developer. This presents a key challenge in rolling back or tracking changes. Use cases added to the system were not documented as such there didn't exist any documentation on requirements or business rules for the various use cases. The architecture of the system is also not documented.

The production database also included some temporary tables that were used for testing or supported functionality that was no longer in use. Coupled with lack of proper indexing on the database tables, it is difficult to optimize performance on the database.

We also discovered that the current application stores passwords as plaintext in order to facilitate password recovery through the instructor account which poses a serious security/privacy risk.

The team uses one cloud hosting server which acts both as the production and test server. This server also acts as the application and database server. This we found was a big challenge in two major ways; There was a risk of test code ending up in the production environment and breaking the system especially if the code had not yet been sufficiently tested and using the same server for the application and database posed a security risk.

#### **2.1.2. Ticketing & Customer Support**

We identified that whereas David is able to support the current active clients by phone and email, the organization was not keeping track of the issues that clients raised, or how they had been resolved. This meant that issues reoccurring took the same time to resolve as the first incident of the same due to lack of records. The organization also did not have a knowledgebase that can be used to support the resolution of tickets/support queries and would in the long run not be able to enable client self-help on their platform.

We also realized that as the number of clients grew, it would become increasingly difficult to for David to provide support to all of them, in good time and still be able to do his other administrative responsibilities. It would also be impossible to measure query response/resolution time in the absence of a mechanism of tracking support tickets.



### **2.1.3. Billing & Licensing**

We were able to identify two challenges in billing and licensing namely, the old technology in which the current billing platform was developed, as well as its interface with the smart futures platform and how licenses are applied to client accounts.

Smart Futures business/licensing model is also changing to include the ability to sell licenses to school districts rather than school buildings. A base number of buildings would be included in the primary license, with additional payments being made for additional buildings. This meant that since the district would be paying, all beneficiaries would share the same license. The current approach of manually applying licenses would therefore be unsustainable, and we found that a safer, quicker approach would be required. The current billing platform, being built on Adobe flash and with support for the technology by Adobe and most browsers being phased out, improvements to this platform would not be possible.

## **3. Process & Technology Improvements and Acquisitions:**

### **3.1. Billing & Licensing**

A more robust billing platform that can support the changing billing approach of the organization is required. There is need to acquire or develop a new billing platform as the current one uses Flash. In consideration of possible platforms, one that can combine the functions of billing and licensing and a client relations management would be most desirable to avoid replication of data on various platforms as a CRM is required for keeping information on clients and market leads.

The billing and licensing database needs to be separated from the Smart Futures platform. This will enable development of the new billing platform to be independent of any changes to the Smart Futures platform.

Changes also need to be made to how licenses are applied by the billing platform to the Smart Futures platform. It is advisable that the Smart Futures platform exposes an Application Program Interface (API) through which licenses can be applied.

### **3.2. Ticketing & Customer Support**

An online platform for support and ticketing system needs to be deployed to support the customer support function of the organization. The system should be set up with a support email address that can be used by clients and a web form on the website through which clients can log their tickets without necessarily having to call David.

A support desk/service desk manual that describes the entire lifecycle of a support request will be required to ensure that every member of the organization doing support knows how to go about this task. This is aimed at ensuring that all support tickets are logged, and solutions attached to the said

tickets for future use in building a support knowledgebase. Further still, this information can be useful in informing the software development function of the organization.

### **3.3. Application Development, Testing & Deployment Processes**

#### **3.3.1. Product Lifecycle Management**

It is advisable that the agile development methodology is adopted with its practices. Iterations and requirements for each should be clearly specified at the beginning and achievements noted at the end. Technical debt carried should also be communicated. I would recommend the use of project management tools such as Trello for the effective management of the processes.

#### **3.3.2. Application Architecture & Use Case Documentation**

As part of improving the quality of the software development function of the organization, it is important that an “*architecture haiku*” of the platform be created and kept on record. This will direct the development and inform such decisions as choice of technologies to use at various stages, but more critically, the quality attributes of the application.

Additionally, use cases should be documented as use case specifications or user stories before they are handed down to the developer teams. They will then be used again in evaluation/demoing and testing of the product to ensure that it meets the requirements. It will also be useful in tracking the changes that have been made to the platform over time.

#### **3.3.3. Implementation of Version Control**

The development team needs to implement collaboration and version control tools. This is critical in managing the development process and tracking changes to the code base. It also makes it easier for various developers working on different aspects of the platform to collaborate.

I would recommend that the organization gets an organization account on GitHub for the developers to use. (<https://github.com/business>)

I would also advise that the team uses the “feature branch” system to manage their branches and master repositories. More information on this can be found in this online guide. <https://nvie.com/posts/a-successful-git-branching-model/>

#### **3.3.4. Testing, Continuous Integration & Continuous Deployment(CI&CD)**

The developer team should also use CI&CD tools in their development. Continuous Integration builds and tests code every time a developer pushes new code into the repository. This ensures that broken code is caught earlier, and remedies found. This eventually saves the team time. Continuous

Deployment works in such a way that once features have been successfully tested and are ready to be deployed by way of being added into the master branch, they are automatically deployed to the production environment. These two practices are useful in improving code quality and deployment of new features. More advantages of these practices can be found here. (<https://dzone.com/articles/9-benefits-of-continuous-integration>)

Tools such as CircleCI, (<https://circleci.com>) Shippable(<https://www.shippable.com/>), and Better Code Hub (<https://bettercodehub.com/>) would be useful in assisting developer teams in improving their code quality.

### 3.4. Hosting

The organization should change their infrastructure set up in the cloud to include a separate test and production server as well as separate database and application servers. In this case, it is advisable that they adopt two instances of application servers, one for the test environment and the other for the production environment and make use of the database containers that come with cloud hosting for provisioning their databases. It is imperative that the databases are kept separate as well. (Test DB should be separate and different from Production DB).

### 3.5. Hire a Technical Product Development Manager

To ensure that the concerns identified and raised under application development, testing & deployment processes, can be successfully implemented, there needs to be a qualified directly responsible individual. This resource would be the mediator between the user department (David, Clients) and the developer team. He would also be the supervisor to ensure that the standards agreed upon with the product client (David) are met. An ideal candidate would be someone with practical experience in software engineering and having been part of a development team that included remote developers. The candidate should also possess excellent written and oral communication skills.

## 4. Measures of Technology Plan Success:

The indicators of the change achieved as a result of implementing these changes would be as given in the table below;

Item	Measure of Success
Billing & Licensing	<ul style="list-style-type: none"> <li>• Reduction of number of operations needed to capture payment and apply licenses to a single operation</li> </ul>
Ticketing and Customer Support	<ul style="list-style-type: none"> <li>• Ability to measure response time</li> <li>• Creation of content to populate the customer support knowledgebase</li> </ul>

<p>Application Development, Testing &amp; Deployment Processes</p>	<ul style="list-style-type: none"> <li>• Improved code quality and reduced code maintenance time</li> <li>• Reduction in hosting budget by up-to half by utilizing database containers offered by cloud hosting services</li> <li>• Instant deployment using continuous deployment reduces deployment time and required human invention thus freeing human resources.</li> </ul>
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**5. Appendix I. – Supporting Documents for the Technical Plan**

**5.1. Architecture Haiku Template**

**5.2. Use Case & User Story Specifications Templates**

**5.3. Cloud Infrastructure Set Up Sample Script (AWS)**