

RESEARCH METHODS – PROJECT PROPOSAL

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Introduction

The first part of this proposal will be where we are going to be considering the scope of the project that I will be working on. Firstly, we will be giving a title to the project to give a better understanding to the reader what the topic will be based on.

Project Title

The title for the research project that I will be undertaking is **Designing a Serverless Framework to build applications for the Drivers Vehicles and Licencing Agency.**

This project is focused on the design of a Serverless Framework that can be utilised in the production of an application. The framework will be built with the plan for DVLA staff members to use alongside the development of their work as a tool that can be used by anyone without much knowledge and allow them to build with the use of automation.

The view taken in this project proposal will be the following statement

- Can the use of an automated Serverless framework to build applications improve the DevOps metrics significantly for a company like DVLA when compared to building an application without the use of Serverless technology?

The following proposal will start with a background review into the project, looking at the reasons why the project topic has been chosen and a little insight into how the DVLA operates. Then the proposal will move onto the literature review to give some knowledge into the technologies being used in the project. Aim and Objectives discussion will follow the literature review before moving onto the research methodologies, Choice of Software Methodology and Project planning and management.

Background Research

The last section was just a brief introduction into this proposal while highlighting the title of the project to give an idea of what the proposal is about and some information about the structure of this proposal. This section will make it more clear about the reasons behind the project.

Serverless technology has been becoming more popular and many organisations are looking at ways to implement this technology due to the apparent benefits it has on the organisation but I want to research into if these opinions are true. There is potential for an organisation with skilled staff members to build an automated framework utilising a Serverless environment to have many benefits for the organisation but I would need to research more to see if this is true and if the benefits, would it be worth the work to build.

DevOps is playing a big part in the way companies are approaching their projects now. Automation of processes is really considered to be the way forward and the cloud platforms provided by Amazon and Google are aware of this and have made use of automation to speed up processes and save on resource costs so much that they can offer a product to customers that will maintain their processes for them at a much cheaper cost to the customer.

The DVLA is a growing government organisation with ambitions of becoming a leading company in Wales in the IT sector. They have many goals that they want to achieve in their Strategy plan from Automating processes, Exploiting Metrics etc. By looking into the DevOps Metrics I would like to discover if using a Serverless framework could help the DVLA with their strategy plan goals and if there are any problems that could occur from using a Serverless environment or not.

The DVLA currently work alongside Amazon Web Services who provide them with a cloud platform and Serverless technology. I will be using AWS as a tool to work with on this project when implementing any Serverless technologies.

That was a brief introduction into the project. The next section of the proposal will now look at the Literature review.

Literature Review

This section of the report will be a brief literature research into the areas of the project that will be important to making this project a success. The review will start off by taking briefly about applications, it will then move into Serverless technology and how they work with applications. Then we will look into the DVLA's Cloud Provider who offer Serverless services – AWS. And finally then briefly touching on DevOps and how AWS supports it.

Applications

The development of applications is very popular in today's world so let's take a look at what an application actually is and what it does. An application is not to be mistaken for just being a computer programme designed by a developer, an application should be a programme designed so a user interacts and performs task on it. [1]

To apply this logic to web applications for example, they could be a variety of different things that a user would use on the web to perform a task. This could be from a simple web page or a full website that have different uses like for example providing functionality that would be required to support a web application. [2]

Serverless

Serverless is the latest new technology out there that deals with the deployment of applications and services. [3] It's known as the next step away from the past ways of using physical servers to implement deployment. [4]

The term "Serverless" is a bit of an oxymoron as it doesn't actually mean it is Serverless. This is due to the way it works. Normally, a Serverless run application would be running on a cloud platform using a cloud service provider AWS, Microsoft Azure for example. These cloud providers would then charge the users for using their service using millisecond granularity to ensure accurate payments are taken. However, physical servers are being used by the cloud service providers to provide this support so the term Serverless isn't fully true to its word.[5]

This approach allows the architectures to worry less about the maintenance and management of the physical servers and use them time more efficiently. [6] They can focus on many different aspects on their system like:

- Coding
- Testing
- Deploying

[7]

We will be taking a look at the Serverless model in detail and how it differs from other models.

Serverless model

The Serverless model is a framework that is described as being “typically implemented as distributed systems with multiple components working together to abstract the system and its configuration from the end-user”, this kind of framework does a lot of work for the user and that gives the idea of it being Serverless. [8]

An important aspect of the Serverless model is the functions and methods used. From a software engineering perspective, functions are designed to take in parameters and return values back. [9] They are important because designing an application in Serverless is to make the components of the system all stateless functions containing a trigger which activates them at a time that can be decided by the developer. [10]

The engine used to implement these functions and effectively make Serverless possible is known as Faas. [11] This engine allows the user to run functions without the worry about how they operate.[12] It is said to be “a computing engine, that allows us to write a simple, self-contained, single-purposed function to process or compute a task”.[11]

Throughout this project we will be using AWS so let’s take a look at the AWS Serverless Framework. The AWS Serverless Application Model or SAM as it’s commonly referred to as is a framework designed by Amazon Web Services which has tools in place to implement the architecture for the creation of a Serverless application. [13]

Amazon Web Services

Amazon Web services is said to be “The world’s most comprehensive and broadly adopted cloud platform, offering over 165 fully features services from data centers globally.” [14] Using cloud technology, it offers a service that looks after the infrastructure of a system for the user. That means that the important stuff that make up a computer e.g. CPU, memory, storage, operating system etc are all offer to you and managed by AWS.[15]

Let’s take a look at the way AWS implements Serverless.

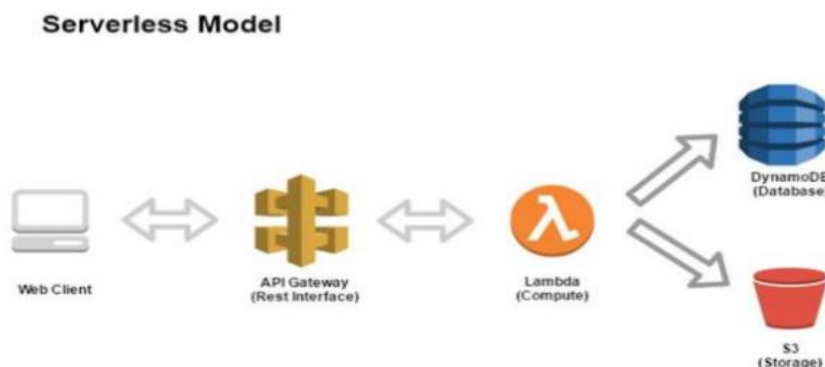


Figure 1- Serverless AWS model [16]

The API gateway acts as a management service for API services and uses REST to apply standards to its service. The Lambda section is simply where the code for the application is sent and executed. If successful, then the data can go into two different storage types. DynamoDB stores the data into a database while S3 is a storage unit where data can be stored as different formats e.g. JSON, XML.

[16]

DevOps

DevOps is described as being a number of best practices that help to make a software delivery process more efficient.[17] It takes a lot of different areas into consideration from the development side and also the operational side of things too. There are a few beliefs that make up the DevOps structure:

- Automation is a big part of DevOps.
- Culture – There's a sharing culture within this community and a real feel of that people make the software and also or that software is designed for people.
- Measuring is also a critical part of the DevOps beliefs. These measurements are to ensure quality is at its highest through the use of metrics.

[17]

This section will quickly look into how DevOps works with AWS.

Amazon Web Services fully endorse DevOps as part of their product and offer a range of services to support it. These services include:

- AWS CodePipeline – Used for continuous integration and service.
- AWS CodeDeploy – Automation of code deployments to speed up the process for example releasing new features.
- AWS CloudFormation – Administrative management system for AWS resources
- AWS CloudWatch – A monitoring service for AWS resources, used to collect and monitor metrics. Log files etc.

[18]

There are many more features that are available on AWS to help with DevOps.

Aims and Objectives

The last section gives a brief understanding on the topics of this project and how they link together. This section of the proposal will highlight the aims and objectives that I plan on achieving in this project. Firstly, all the aims of this project will be listed below in bullet points. Then under each aim, a list of all the objectives will be listed to show the plan to achieving these aims.

Aims

- To critically evaluate Serverless technology, DevOps and their importance to an Organisation.
- Identify if a Serverless approach can improve the DevOps metrics of an application.
- Identify if any improvement is significant to make a difference to the organisation.
- To build a Serverless Framework for the implementation of applications.

Objectives

Now that we have set the aims of this project, let's take a look at the objectives that will help us achieve these aims.

To critically evaluate Serverless technology, DevOps and their importance to an Organisation.

- Get access to the UWTSD research facilities online.
- Critically evaluate Serverless Technology in general looking at a description of what Serverless is, the Serverless Model and how it works, Benefits and Drawbacks etc.
- Critically evaluate Devops in general, the features of Devops, Devops metrics, Benefits and Drawbacks etc.
- Research into how DevOps Works with alongside Serverless.
- Research into how DevOps fits into an organisation.

Identify if a Serverless approach can improve the DevOps metrics of an application.

- Test DevOps metrics of an application not using a Serverless environment.
- Test DevOps metrics of an application using a Serverless environment.
- Compare the results of both tests.

Identify if any improvement is significant to make a difference to the organisation.

- Examine results of the tests.
- Identify whether the results show a difference to DevOps metrics or not.

To build a Serverless Framework for the implementation of applications.

- Identify key areas of an application
- Build a User Requirements list
- Design components of framework following requirements list.
- Test components of framework.

Research Methods

In the previous section, we covered the aims and objectives of the project and in this section we will look into the methods that will be used in the research side of things. Before we can talk about the methods, we need to choose a methodology to follow.

Methodology

For this project we will be following the research onion designed by Saunders et al where the following areas are considered:

- Philosophy
- Approach
- Strategy
- Choice
- Time Horizons
- Techniques and Procedures

[19]

Illustration 1: The Research 'Onion'

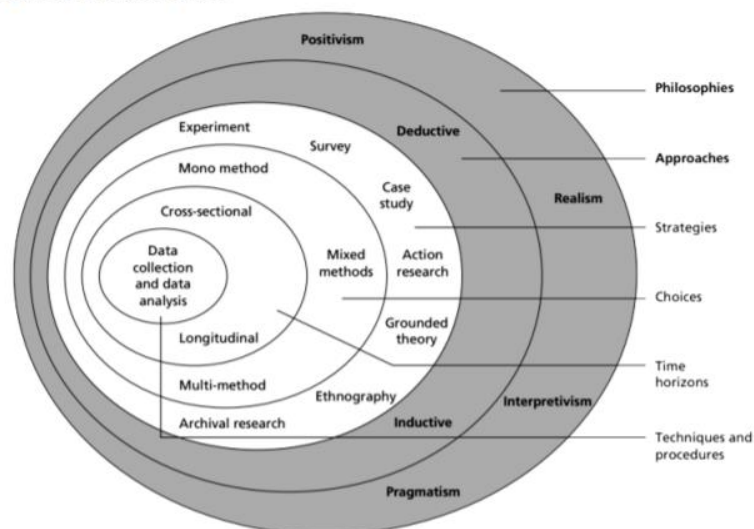


Figure 2- Research onion Saunders et al [20]

This section will state a method chosen, the reason why it has been chosen and any issues that could occur using this approach. Let's start by unpeeling the onion.

Philosophy

In the research onion methodology there are four choices to make for the philosophy area, Positivism, Realism, Interpretivism and Pragmatism. The philosophy that will be used in this project will be Positivism. Positivism is described as being the philosophy of testing hypothesis to answer research questions and for this reason i will be using it to test a hypothesis to answer the research questions I will be looking to find out the answers for.

It would have been possible for me to use the Realism philosophy as it's said to share similarities to Positivism. However, there are some issues with Realism compared to Positivism when the methods for research are considered. Realism is said to not be trustful of the scientific methods and that it's a belief of going back over and looking for new ways of methods. It would take more complex types of research than I require for this project.

Approaches

Now that we have discussed and chosen a Philosophy for the project, we now need to take a look into the approach we are going to take. There are two approaches that can be chosen in this layer of the onion:

1. Deductive
2. Inductive

The approach that this project will be taking will be the Deductive approach. The Inductive approach takes more focus on the theory side of things while not taking much interest into the question that this project is looking to answer. It would only really benefit using that approach if there was little research on the area while on the other hand, The Deductive approach is perfect for what I am trying to achieve.

The deductive approach works well with a project that starts out with a questions and the research throughout it works towards giving you an answer to the question. This project is starting off with the question of:

can the use of an automated Serverless framework to build applications improve the DevOps metrics for a company like DVLA when compared to building an application without the use of Serverless technology?

The whole process of this proposal is working towards finding an answer to this question and for this reason a Deductive approach was most appropriate.

Strategy

We have now chosen a Philosophy and an approach so let's move onto the next layer – Strategy. There are a variety of options that you can choose for the strategy layer as shown below:

- ✓ Experimental
- ✓ Survey
- ✓ Case Study
- ✓ Action Research
- ✓ Grounded Theory
- ✓ Ethnography
- ✓ Archival Research

For this section 3 choices will be chosen as part of this project. These choices are Document Review, Experimental and Software Development. One of these strategies are from the research onion while the others are also important to the project. Using these 3 strategies will allow me to compare the results of them all to get a clear, more accurate result at the end.

Experimental is more suited to this project as the results would need to be analysed statistically while allowing the results to be replicated in the future. Document review is a good way to learn new information and when balanced with the statistical analysis from the experimental side of the project can provide some very interesting results. A building of a framework as part of the software development side will hopefully take the results of the analysis and provide the DVLA with a working product that benefits them.

Choices

Layer 4 of the research onion takes us to the choice section. For this choice it will become more clear as the research starts developing if one type of data – Quantitative or Qualitative will be used more or if a mixed methods approach will be used.

Time Horizons

This section will look into the next layer of the onion Time Horizons. The options for this layer are Cross-Sectional and longitudinal. For this project the best option will be the Cross-Sectional. This is because it is more suited to project like this which isn't a project that will have a long duration. Cross-Sectional looks at data at a single point of time which is exactly what is needed for this project.[21]

Risks & Limitations

So we have now chosen the areas of the onion we will be following so let's take a brief look into the Risks and Limitations that could become a problem in the process of this project. A list of the risks will be displayed below and then a list of the limitations below that. It must be highlighted that more issues could be discovered later into the project and added to the list.

Risks

- Scope expanded.
- Personal data – GDPR
- Lack of planning
- Requirements changing continuously
- Government policy

Limitations

- Costs
- Time constraints
- Software tools available to me

Data Evaluation

Now that the Risks and Limitations have been considered, lets finish off this section of the proposal by discussing how the data will be analysed and the results evaluated. Also discussion will be made about how the software will be evaluated.

From the research part of the proposal data will be analysed by using DevOps metrics software to gather the information and looked at more thoroughly. The use of statistically analysis will be used to compare the results of the two tests and used as evidence to answer the questions needing to be answered in this project.

Testing is a big part of the software development side of this project and tests will be used to ensure the framework is of a working quality. The type of tests that will be used: (Other tests could occur during the production of this product).

- Unit Testing
- Acceptance Testing
- Integration Testing
- Backend Testing
- User Testing

Development Methods

Software Development Methodology

The last section we looked into the Development methods that will be used in this project, in this section of the proposal will be looking at the choice of Software Development Methodology that I will implementing into my project. First I will discuss the importance of a using a methodology, then declare my choice of methodology and finishing off the section by talking about the methodology of my choice.

Why use a methodology?

Every company working on software projects will need to have some sort of framework in place for every stage of process. This process is known as a lifecycle and to implement a lifecycle they must choose a methodology which suits the project they're working on and also the developers as they must understand every process to make it successful. [22]

Now let's move onto the methodology being used in this project.

Methodology of choice

The methodology that will be used throughout this project will be an Agile Approach methodology and the choice of Agile approach will be Rapid Application Development. The methodology would have to be effective for smaller projects like this one, work out requirements with the stakeholders e.g. Users, designers etc. Regular feedback from the users through development and have an emphasis on developing and testing before implementation which RAD ticks all the boxes for this project.

What is RAD?

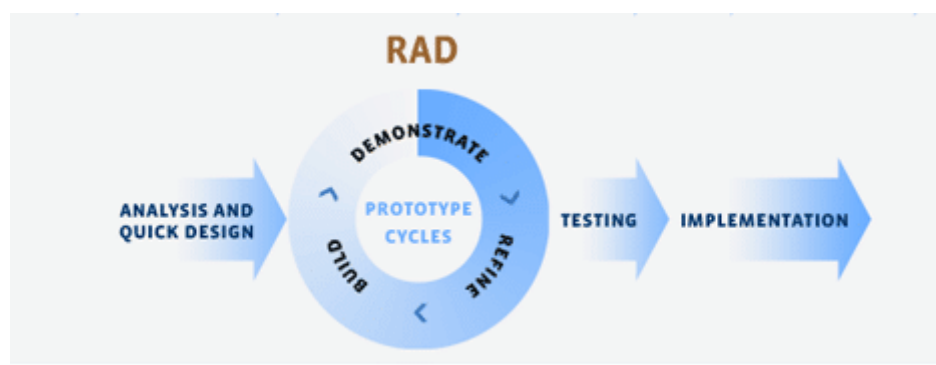


Figure 3- RAD design model [23]

So to be brief, Rapid Application Development is a software development methodology that follows the Agile approach. The key feature of this methodology is that it dedicates to making software work effectively with the use of user feedback and repetitive of testing. It takes the following steps throughout it's life cycle.

1. Requirements - Gathering of requirements from stakeholders in the project.
2. Prototype build – Based off the requirements, a working prototype will be built to be improved upon throughout project.
3. User Feedback – Throughout design of the product, user feedback will be given so the product can be tweaked to improve its quality.
4. Repeat- Until the product matches the satisfaction of the stakeholders, steps 2 and 3 are repeated.
5. Testing – Next comes the testing part of the process, There's a big emphasis on testing so running through the system in all different situations to make sure it's working the way it should is important here.
6. The final stage- Presenting final product!

[23]

Resources & Planning

This final section of the proposal will discuss the resources required in the implementation of the project. This section will also show the planning process of the project in the representation of a Gantt chart.

Resources Required

The following resources will be required in the research area of the project.

- Access to a DVLA laptop – To be able to complete the research
- Access to the internet – To be able to access online research sites
- Microsoft Word Software – To write up results of research
- Access to UWTSD Online library – To access the universities research facilities
- Access to UWTSD Library- To lend books for research

The following resources will be required in the implementation area of the project.

- Access to a DVLA laptop- To build the software
- Access to the internet – As part of the development of the project
- Access to Amazon Web Services – To use their Serverless
- Source code editor Software e.g. Microsoft Visual Studio Code

These are the requirements believed to be needed to make the project a success however, these requirements may change or more requirements may be required that were not initially thought of as requirements in this proposal.

Gantt Chart

In order for the project to be a success, a plan needs to be put in place to manage each step of the way. To achieve this, I will be implementing a Gantt Chart which will be split into 2 parts – the research and the implementation. Under each section will be a list of the tasks needed to complete the area with some tasks depending on the success of other tasks. Estimated time scales based on realistic timing will be added to each task e.g. 1 week to complete a simple research task but more time for a task that requires researching more than one area.

Gantt Chart - Project overview

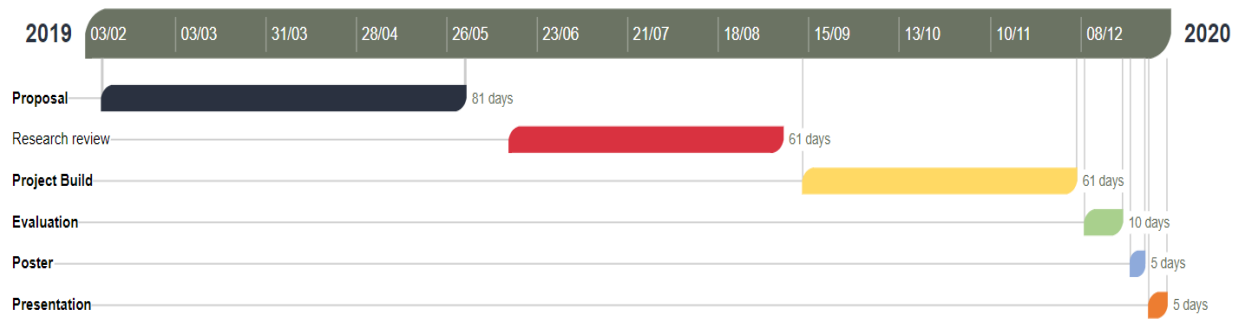


Figure 4- Gantt chart 1

Gantt Chart - Research Review

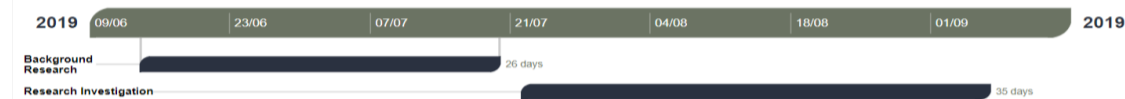


Figure 5- Gantt chart 2

Gantt Chart - Project build

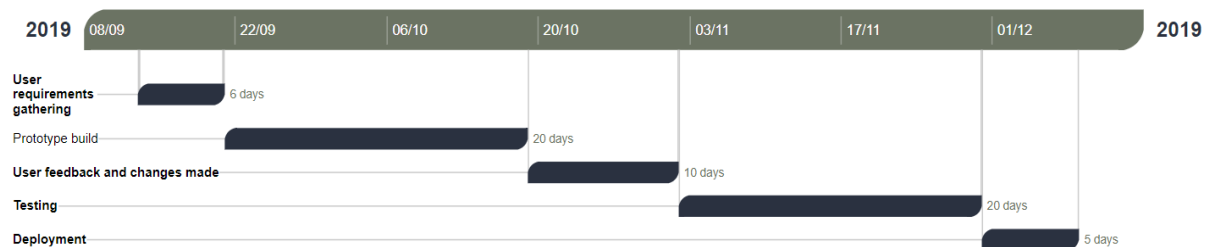


Figure 6- Gantt chart 3

These are the plans that I will be following throughout the whole course of the project. The planning is not an accurate representation of the structure of the project due to estimated times being used and timescales can change given the difficulty of tasks or unforeseen circumstances. It is fair to say that once the project is progressing that it'll become more clear if the plan being used is achievable or not.

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