**Industrial Placement Log of Work**

*Student: Matthew Frankland (H00241997)*

*Placement Company: Exterity Ltd, Dalgety Bay, Fife*

*Submission Date: 04/01/2021*

This document contains a "Log of Work" and serves as a component of my evidence of learning during my industrial placement with Exterity, an IPTV & Digital Signage Solutions company. I worked with Exterity for 3 days per week from 15th September 2020 and on a full time basis from 1st October 2020 until 31st December 2020. I have previously been employed with Exterity and during that time I worked on an internal tool called 'Solution Builder'. This log of work starts with my continued development of this project, and later includes details on a variety of new projects that I was involved in. More details on this tool are given in my reflective report.

**Week 1 - 15th September 2020 - 17th September 2020**

*Tuesday*

I am currently researching the design and architectural decisions required for a variety of new administrative tools that are to be added to version 2.0 of 'Solution Builder'. Levels of permissions will be required for each tool and not all users will be able to access all data in the tool. I have also removed some end of life products from the database.

*Wednesday*

I investigated the need for a region-based email list so that Sales Directors can see what product specifications end-users are creating in their region. 'Solution Builder' is however most widely used in a handful of regions. This data would also give Product Management a means to push the use of 'Solution Builder' in regions where it is not currently widely used as they could demonstrate the benefits of it using this data.

*Thursday*

I have started preparing for the release of version 1.6.14 which will contain a number of end of life changes, bug fixes and UI simplifications. This tool normally has a hard release however I have begun setting up a quality assurance testing process for releases which will begin from version 1.6.15. This is to provide more reassurance if the tool is to be pushed for wider use by Product Management.

**Week 2 - 22nd September 2020 - 24th September 2020**

*Tuesday*

After some discussion, the administrative tools to be added to ‘Solution Builder’ have been narrowed down to: an analytics tools (to help give a better understanding of where and how the product is predominately used); a data updater (to remove the influx of emails to myself for simple tasks that could be done regionally, such as updating channel data); region-based email lists (for Sales Managers to have a targeted approach to clients who produce product specifications through ‘Solution Builder’) and a simple/advanced view (as there is a lot of information shown in the standard view which can be confusing to a new user). Continuing to work on database permissions for these tools.

*Wednesday*

I have created an sql script that will add an additional database table marking out the permissions of which users can access what administrative tools. These permissions also store what data is to be displayed inside a particular tool to each user. An investigation was done as to whether these permissions could be added through Zendesk (an OAuth2 support portal) however it was decided to keep this data locally on the system as the number of users with permission to use the tools will be much lower than the overall user base.

*Thursday*

I investigated how to store user regions within ‘Solution Builder’ as Zendesk does not return a user location. I concluded that retrieving a persons location via their email address was the best option available. This new data was stored against all active members of the system, as well as being added on a users registration.

**Week 3 - 29th September 2020 - 2nd October 2020**

*Tuesday*

I am looking at implementing a change for ‘Solution Builder’ so that user registration requests are automated and do not need to be sent directly to me. This would involve retrieving all user information from Zendesk, storing in the appropriate databases and setting the global login state in a ‘Solution Builder’ build.

*Wednesday*

The above implementation is currently blocked as a bug was found where competitors are also registered if the process is automated. The implementation would work in the short term on the development build of ‘Solution Builder’ but a change will be needed on the Zendesk side to make more tags available over the type of user account, for example a customer or competitor. I also removed some more end of life products which are due to reach their expiry in October.

*Thursday*

I began work on user interface design for the channel updater administrative tool. I created a PHP script with a variety of SQL queries to retrieve the data that is to be displayed. All foreign keys were removed for security however this adds an extra level of complexity when implementing direct editing of the database. This is because there will only be fixed number options that a user can change some columns too, rather than any arbitrary string, and more investigation will be needed to find an efficient way to solve this problem.

*Friday*

I displayed all data that was returned in the above queries in a variety of tables on the client side. This data is protected by the OAuth login system that includes the automated registration system that is currently blocked from the live site.

**Week 4 - 5th October 2020 - 9th October 2020**

*Monday*

I prepared a new release of ‘Solution Builder’ - version 1.6.15 - which includes a variety of product changes in the price book, end of life changes, and product adjustments. This release passed internal automated testing, quality assurance testing, and regression testing before being successfully released. This is expected to be the last version of ‘Solution Builder’ before version 2.0 is released.

*Tuesday*

I finished the channel updater user interface. This tool can now send emails through a POST call. Emails contain a user’s recommendations for table rows to be edited (with suggestions of what the data should be changed to) or deleted. Edit suggestions are entered through a jQuery UI pop-

up modal. I also added the ability to directly delete or edit some tables however changes still need to be made to build dependencies before this functionality can be used.

*Wednesday*

I moved onto working on the analytics administrative tool. My aim was to create a local NodeJS script that generates all analytics data in a serialised format, using a variety of node modules, that can be bundled and placed on the web server. One major problem I encountered was that the 'net' module required and used in the mySQL node module is a core part of Node.js. Therefore when the script was bundled it was creating an empty object on the web server. I worked round this by creating an Ajax call for the relevant queries and then continuing with the script. This was not optimal as the call had to be synchronous to be used in the bundle I created.

*Thursday*

I continued work on the above today. I found methods for making the bundle asynchronous and added additional options for analytics to be generated for each quarter rather than only the previous quarter. I added the php library 'f-pdf' in order to graph and display the analytics data.

*Friday*

I completed backlog for 'Solution Builder' as this was the end of the 2 week sprint. We discussed a variety of product updates which I later processed into the development build. I also started planning the layout of the analytics document I will create using the 'f-pdf' library.

**Week 5 - 12th October 2020 - 16th October 2020**

*Monday*

I have encountered a number of issues whilst using the analytics bundle. The primary issue is that the data generated from the database is in UTF-8 encoding format. 'f-pdf' does not support UTF-8 special characters and fonts are encoded in ISO-8859-1. Some characters can be decoded using PHP's 'utf8_decode()', but others do not translate correctly such as the euro sign.

*Tuesday*

I solved the above issue using the PHP library 'iconv', a program for converting between different character encodings. I continued working on the layout of the analytics document with the aim

being to have it finished by early next week. I also attended the retrospective, demo and poker planning meetings for Exterity's cloud suite. At these meetings I demonstrated my current working prototype of Solution Builder version 2.0. This was challenging as I have little experience presenting to an audience however my work seemed to come across well and I was able to answer a number of spontaneous technical and product management questions.

*Wednesday*

Holiday Day

*Thursday*

Holiday Day

*Friday*

Holiday Day

**Week 6 - 19th October 2020 - 23rd October 2020**

*Monday*

Continuing on from last weeks challenges, I have added additional options to the analytics splash screen. These options allow a report to be generated for each of the previous four quarters, as well as the current quarter. I have started to create the final analytics document with the 'f-pdf' library, focusing firstly on a summary containing the average projects per month, average channels per month, average number of endpoints per project and total quotes per quarter.

*Tuesday*

I have been focusing on adding further data to the above analytics document. I graphed what percentage of user builds contain a specific product, for example Signage; Smart Displays; AvediaServer or Transcoders. I also included the difference in results between the selected and previous quarters in the graph labels.

*Wednesday*

I have added more data to the analytics document including a project count sorted by solution type and a generated BOMs count per user sorted by company. AvediaServer 9.7 was also in regression testing today. I wrote a short python program for this to collate the licence information of npm packages, which is needed for the PAC process. This was helpful for the build and easy to do. I recursively traversed the directory tree and simply checked each package.json file found.

*Thursday*

I have added the final graphs to my analytics report today. These graphs include data on the number of Smart Display builds versus standard builds, the number of builds created per month, and the number of builds created per country.

*Friday*

I completed backlog for ‘Solution Builder’ as this was the end of the 2 week sprint. Our main discussion was around adding two new encoder licences. The action to add these licences is currently blocked due to the wide number of build permutations that they could be applied to. This makes the programming of these new licences quite challenging. It was decided to make each encoder option on ‘Solution Builder’ mutually exclusive while quality assurance decides the best approach.

**Week 7 - 26th October 2020 - 30th October 2020**

*Monday*

This week I have been finishing development of the administrative tools, completing end of life stories, and fixing any remaining bugs before a new build of Solution Builder next week. A new bug was reported today which can send the website into an infinite refresh cycle. I identified that the issue was associated with cookies not being stored in a browser after OAuth, or storage being denied because of a browser’s settings. I implemented a fix for this.

*Tuesday*

After yesterday I have been feeling the time pressure to get everything completed for the new build next week. I have been slowly improving my time management skills to try and cope with this pressure. I focused on finishing the channel updater. I added the ability to send email notifications about other out-of-date database tables and improved the levels of data validation when

editing; deleting; or inserting on the channel table. I also fixed a bug where email notifications would fail silently if the message body contained utf-8 characters.

*Wednesday*

I added the new NDI and SRT encoder licences which were discussed last Friday. The custom data-tables package that Solution Builder uses made the mutual exclusivity of the NDI, SRT, and HDCP options tricky to implement. This was because the package tightly couples each form option together and thus changes I made could cause some build combinations to fail. I opened a story to refactor this code in the future.

*Thursday*

Foxtel in Australia have today sent through new channel frequency changes that need to be updated in the Solution Builder database. I spent the day actioning these updates. Once the channel updater is launched next week, I should not need to complete this task again.

*Friday*

I added an additional option to the analytics administrative tool. The tool would previously generate a report for each of the four previous quarters before the current quarter. Now an additional report can be generated for the current quarter. This helped identify a new bug in the analytics bundle, which occurs while calculating the ‘total number of endpoints’. I changed this statistic in the report to take the sum of the number of endpoints for each reported month. I have opened a story to look at fixing this statistic in the analytics store at a later date.

**Week 8 - 2nd November 2020 - 6th November 2020**

*Monday*

This week was the final week of working on Solution Builder version 2.0. My focus was on finishing all remaining bugs, creating automated tests for new features, running regression testing, and submitting my work to quality assurance. Today I worked on refactoring the NDI/SRT licence selectors which I added last week. I also fixed a bug where the quantity of HDCP encoders was wrongly calculated if only once HDCP encoder was selected.

*Tuesday*

Today I ran regression testing on Solution Builder. This tests that all expected order codes are included in the database and that a series of pre defined build requests match the expected specification. Most pre defined build requests required adjusting to account for end of life products that have been removed in this build. I copied the results of my tests to a text document for quality assurance to review later.

*Wednesday*

I created a series of automated regression tests for Solution Builder's new analytical tools. Each test creates a single NodeJS executable environment which makes use of Google Chrome's web driver. This automation work saves time, is highly efficient and is more accurate than manual testing.

*Thursday*

I completed backlog as this was the end of my two week sprint. The discussion in backlog was not centred on Solution Builder but on what my next task would be after the release of version 2.0. My next task will include more analytical processing, this time on Exterity's internal agile development tracker. Most of the tracker's APIs are restful therefore this project will be mostly done in Python. Any older SOAP APIs will require C or C#. This will necessitate some learning on my part as my primary expertise is in scripting languages. I also submitted Solution Builder version 2.0 to quality assurance for review.

*Friday*

I started to plan a strategy for my new project. This was a new experience for me as I needed to learn about who the stakeholders of this project are, discuss the requirements with my line manager, and do more research into the languages I will need to use. I also opened a new story to work on architectural documentation for Solution Builder once it has been approved by quality assurance.

**Week 9 - 9th November 2020 - 13th November 2020**

*Monday*

I spent the day writing architectural, user, and install documentation for Solution Builder. This task was important as it will help keep track of all aspects of the application and help improve upon the code quality in future updates. As I will soon be moving to a new project, this documentation will also aid whoever takes over the responsibility for maintaining Solution Builder.

*Tuesday*

Solution Builder 2.0 has been returned from its quality assurance review. An issue was raised regarding the development build which could not be accessed out-with Exterity's local area network, even over the VPN. This was a problem as most employees are working from home. Otherwise all test suites passed successfully. While I investigated the issue raised, I updated the SecureMedia codes in Solution Builder and added a missing moment of exclusivity licence.

*Wednesday*

I was able to diagnose and fix the above issue which was occurring on the network's transport layer due to security restrictions on the SSL certificate. A simple adjustment to allow outside connections when routed through the Exterity VPN fixed this issue.

*Thursday*

Solution Builder 2.0 has been released. Some feedback has been received through Product Management which upon investigation included two bugs: no chassis is being added for an ATSC Gateway; and no chassis is being added for any encoder. I will patch these bugs in a later update. At the end of the day I was told that my next project had been changed to creating an automated media testing harness in Python. I got access to an Encoder in order to work on this project.

*Friday*

My aim for today has been to setup everything I will need for my new project. This includes having access to: an AvediaServer; a h265 stream of several minutes in length; a play module in the AvediaServer; and a record module on the transcoder. I also got access to the transcoder's restful api documentation to learn how to convert an h265 video stream to h264.

**Week 10 - 16th November 2020 - 20th November 2020**

*Monday*

I have started writing Python code for the automated media test harness. I focused on creating a function for each AvediaServer API request. Documentation for the API was provided in the source code, and thus the process was fairly straightforward. I added a function for creating a new play channel, scheduling content, and starting a recording.

*Tuesday*

I have not been able to find any method for uploading content to an AvediaServer except through the User Interface. There is no externally exposed way to upload files to the correct directory in order for a POST request to work with these files. This turned out to be intentional in order to split out GET and POST requests from internal and external API.

*Wednesday*

I have created a JSON configuration file which accepts an ip address for an AvediaServer and a Transcoder. The configuration file also accepts an array of 1-* video asset titles. If these assets exist on the supplied AvediaServer, they are used during testing. I have also added functions for verifying that each endpoint's ip address is active on the local network, that the endpoint is of the right device type, and that the device's public facing api is available.

*Thursday*

I have created a new function which passes data on the live play channel to the Transcoder so that it can start listening for content. The transcoder receives content from the play channel and output the transcoded content to the record app. I have also added new delete functions to the test harness. These functions delete the play channel that is being used for testing in order to stop duplicate channels being created if the test is run multiple times.

*Friday*

I had hoped to present my work on Monday, however I have run into some issues with the Transcoder. The live channels that the transcoder is listening to were not being shown on the User Interface. After investigation, the channels were being listened to but a bug caused this information not to be shown to the user. Recordings are also failing because of a SIGABRT unknown error. This will require further investigation.

**Week 11 - 23rd November 2020 - 27th November 2020**

*Monday*

I investigated the issues I have been having with the transcoder and found a bug that I have raised with the AvediaStream team. Where API requests are sent with malformed data, the

transcoder could go into an infinite loop while retrying the invalid request. In this scenario the request would never be dropped, creating a backlog of failed unprocessed requests which I cleared from the API.

*Tuesday*

The problems I was facing with the transcoder User Interface were related to the issue I fixed yesterday. A javascript error was preventing all live transcodes being shown if any API request contained data that was malformed. The transcoder's total output would however be correct for all requests, including those not shown.

*Wednesday*

I have expanded the streaming test harness's configuration file to allow a wider range of IO devices, and not just AvediaServers and AvediaStream transcoders. This included, for example, adding parameters that set transport options, the muxbitrate, and the codec of the output. These additions will only work if the APIs on the IO devices have the same request addresses, which should be the case for all Exterity products.

*Thursday*

I have started testing my script using a variety of landscape, portrait, 16:9 ratio, and widescreen h.265 transport files. An issue has arisen where the bitrate of the transcodes input could cause an output delay. Recordings also appear to be in the original codec instead of the transcoded codec. Both of these issues require further investigation.

*Friday*

To fix the above issues, I adjusted the bitrate for Ultra-HD transport streams to fix the rate at which data is received by the transcoder. I also added code which delete any resources created by this script when a user throws a KeyboardInterrupt or the script execution finishes. This concludes my programming work on the test-harness and I will present a demo next week which showcases how to use this script.

**Week 12 - 30th November 2020 - 4th December 2020**

*Monday*

Today I went back to a few bug fixes that have been requested for Solution Builder, while I await feedback on the streaming test harness. These were related to SecureMedia and endpoint quantity calculations.

*Tuesday*

I continued working through some of the bugs that are left in the backlog after the release of version 2.0 of Solution Builder. I selected two stories to work on today, a bug related to builds not being registered in the analytics store and a story to add a new selector to the UI. This selector will give users a better method of selecting their required licences in version 2.1.

*Wednesday*

I have received feedback on the streaming test harness however a couple of bugs have been reported in relation to Solution Builder. When a channel is selected, an encoder chassis is always added at an incorrect quantity. Additionally, the DNS redirection from a 'www' address to a 'non-www' address appears to be failing which is causing some problems for American sales reps.

*Thursday*

The DNS bug from yesterday has now been fixed. The problem was related to the ServerAlias that was set in the SSL apache2 file. I am still working on the encoder chassis issue which is proving trickier to fix.

*Friday*

I have found a fix for the issues related to the encoder chassis, which was caused by an incorrect calculation during a build's generation. These bug fixes have now been put to review before deployment. I have had a brief look at the streaming test harness feedback however I hope to focus more on this next week.

**Week 13 - 7th December 2020 - 11th December 2020**

*Monday*

I have now actioned the feedback that I received regarding the streaming test harness. Firstly I adjusted my code's paradigm as I was working under the presumption that the play or record

module would always be interoperable through an AvediaServer API. This turned out not to be the case and the script should work with any unit under test that contained these modules.

*Tuesday*

I have continued actioning the above feedback. I changed how the bitrate of the record module is set by hardcoding the value to that which is returned by the play module. I had previously allowed the bitrate to be set in the configuration file however this was causing silent failures in FFProbe (a package that is used to check a videos encoding format).

*Wednesday*

I have created a JSON schema that checks the format of the configuration file. I also added a validation step to the streaming test harness that validates the configuration file against the schema to prevent any additional parameters being added. Some JSON objects are sent from the configuration file without individual key checks thus this should help prevent many API errors.

*Thursday*

The streaming test harness is now up for all of the core and user experience team members to review. I have, in the meantime, returned to focusing on Solution Builder. Build emails are now sent to sales representatives by region, and a patch for a missing c1210 chassis in some regions has been deployed.

*Friday*

Today I followed on adjustments that were due to be made to the registration script a number of weeks ago. I asked for user tags, which are missing from the Zendesk OAuth API, to be added to allow for certain user types to be rejected from Solution Builder (e.g. Competitor). Until this is done, which will most likely be in the new year, the connected story will have to be postponed.

**Week 14 - 14th December 2020 - 18th December 2020**

*Monday*

Today I worked on a final couple of issues with Solution Builder. The availability to promise figure on quotes does not match that shown in Salesforce. This may be because stock management is now controlled by a different company, and the API salesforce settings have not been updated.

The second issue is that price-books are only returned if their currency matches the personal Salesforce accounts currency (thus if no currency is set then no price-books are shown).

*Tuesday*

I have updated the Salesforce API from SOAP to REST at the same time as patching the first of the above issues. This should allow for a faster API that can be used with the more modern and widely distributed JSON format. I am still looking for a solution to the second issue.

*Wednesday*

In investigating the second issue, there may also be incorrect job references that are carried over from Salesforce. This suggests refresh requests are not being carried out during a users session as Solution Builder doesn't hold job roles. I have decided to put this issue back to backlog, as it has yet to cause an issue, and will reopen it if a bug is raised in the future.

*Thursday*

It has now been arranged for me to come back to work at Exterity in the new year. I have therefore been asked to focus on the projects I will begin the new year. These will mostly be cloud related and connected to moving an AvediaServer into the cloud using AWS. Specifically in adding more device information to the website which can be put in the cloud-side database.

*Friday*

In preparation for future work, I spent today building and getting set up with a cloud system, hosted on my internal webspace. The cloud version was build from the latest copy of the trunk branch on Exterity's version control.

**Week 15 - 21st December 2020 - 25th December 2020**

*Monday*

This week, as it is my last week, I will focus on writing the project documentation for the various projects I have been working on. This includes technical, architectural and user documentation that can be used by future maintainers of the projects. I will store the information on Exterity's internal open-source documentation platform, called Bookstack, and internally with the source di-

rectory. The project I focused on first of all was Solution Builder, which I had already partially started.

*Tuesday*

As above, I completed the documentation for the streaming test harness and the licence extraction script.

*Wednesday*

I have committed all projects that I had been working on over the past 15 weeks, published the documentation and did a short presentation on how to use both the licence extraction script and streaming test harness. I will be returning to Exterity in the new year, working one day a week, and thus Solution Builder has been tidied up for me to return to at this later date.

*Thursday*

This is my final day with Exterity for the period of this Industrial Placement. It has been a great success and has helped improved my technical skills, such as in AngularJS and NodeJS; product managements skills, in coordinating testing and deployment of a living product; and non-functional skills, such as prioritisation. I will continue to improve upon the wide range of skills I have acquired during my time with Exterity as I seek to continue improving my Software Engineering skills in industry.

*Friday*

Holiday Day

**Week 16 - 28th December 2020 - 31st December 2020**

*Monday*

Holiday Day

*Tuesday*

Holiday Day

*Wednesday*

Holiday Day

*Thursday*

Holiday Day

Grant Prophet

Senior Product Manager

**Industrial Placement Reflective Summary**

*Student: Matthew Frankland (mf48/H00241997)*
*Placement Company: Exterity Ltd, Dalgety Bay, Fife*
*Submission Date: 04/01/2021*

Throughout Semester 1 of 2020/2021 I have undertaken an industrial placement with an IPTV & Digital Signage Solutions company called Exterity. Due to the COVID-19 pandemic, this placement was undertaken on a work-from-home basis. The purpose of this report is to critically reflect upon the experience, the new skills I have acquired and the challenges that I faced during my internship.

I was initially hired by Exterity in June of 2019 and completed my first summer internship with the company in September 2019. I have since been working with Exterity part time before returning to complete another summer internship this year. This report focuses on the initial interview process, and the specific 16 week internship as a Software Engineer with Exterity from the 15th September 2020 to the 31st December 2020. The primary focus of my internship, among other smaller projects, was around upgrade and support for an internal application called 'Exterity Solution Builder'. This tool is used by sales representatives to create custom theoretical product specifications for customers in their varying environments and scenarios.

In order to gain my internship, I had to complete a face to face interview answering questions specifically on my computer programming skills, as well as questions exploring my own strengths. The interview also included a 2-part practical exercise, one using an Exterity Media Player and another using a Mindstorm robot. These exercises allowed me to demonstrate both my problem solving skills and my ability to complete tasks in a limited time frame. I was proactive in preparing for this interview by reflecting upon the benefits and disadvantages of the languages that Exterity would most likely ask me to use, primarily JavaScript. I conducted myself with a professional attitude, demonstrating that I would be a good representative of the company and that my personality would be well suited to Exterity's professional working environment.

Looking back at the interview process, one thing I showcased well was my portfolio of previous projects. My portfolio allowed me to show, not just my academic skills, but also how I am able to apply those skills to real world problems. One criticism of myself would be that I did not tailor my portfolio enough around the languages that I knew would be pertinent to the role I was applying for. As I had little experience of these types of interviews I included a wide range of programming languages thus some projects did not demonstrate any relevant skill and took up valuable time. I should have focused on the knowledge and skills most relevant to this position.

Throughout my first four years as an undergraduate, I had little industrial experience working as part of a software development team. I was however able to adapt quickly to this change thanks to the agile development methodology that Exterity use. Agile development refers to an iterative design approach that emphasises collaboration, communication and knowledge sharing (Begel *et al*., 2007). A number of meetings took place as part of this approach, including: a daily scrum (for the purpose of quickly informing everyone about what is going on across the team); sprint backlog (which takes place at the start of an iteration for the purpose of prioritising tasks and planning the team's approach for success during this sprint); poker-planning (which takes place at the end of an interaction for the purpose of showcasing the work of the team); and retrospective (which takes place at the end of an iteration for the purpose of giving rapid feedback on development and understanding anything that went right or wrong) (Yilmaz, 2019). The daily scrum was especially important during my internship as this was my chance to gain experience from others, ask questions about current problem areas and make suggestions to others. As someone with less experience in a large software company, these interactions with more experienced engineers helped me develop my programming skills at a much faster rate than I would have in a traditional working group. I also benefited from the shared spreading of knowledge from a variety of different areas, broadening my knowledge and skill set.

'Exterity Solution Builder' was a demanding task and required multiple skill sets in order to complete it. I did however feel a sense of pride at the end of my internship seeing the product being used in the field, having completed 4 minor releases and 1 major release. My initial responsibilities with this cloud based tool were: to become familiar with the code base; action triaged bug reports and process new user or data update requests from outside of the company. Initially I struggled to manage the amount of programming tasks, code reviews and requests I was receiving. However as the internship progressed my prioritisation skills improved immensely. By the end of the internship I learned to allocate a sufficient amount of time to planning and preparation before beginning any task (both personally and as part of poker-planning/retrospective), distinguish between the most and least important tasks (using Exterity's system for logging bugs; tasks; or investigations), and balance my time well between tasks; while being realistic about what was achievable given the time allocated.

Once I had completed this initial work, my next task was to develop a version 2.0 of 'Exterity Solution Builder'. This new version included a number of new tools to improve productivity and provide greater insight into its current use by sales representatives.

The first stage of this process was to create a series of wireframes and prototypes in order to demonstrate my design and architectural approach. This was challenging for a number of reasons. Firstly, I was working with an incomplete concept which still had gaps that would not be filled in until development had started. On reflection, it would have been better to create wireframes for each redesigned element, rather than for the system as a whole; this would have better ensured that my focus remained on the components that had been thought through and not drifted towards decisions that had not yet been made. Secondly, I was working with predicted, rather than decided upon, metrics. For example, one of the new tools was to be used for gathering analytics. Not all the metrics that were to be displayed were firmly established while I was prototyping but I worked around this problem using a handful of key metrics. These key metrics demonstrated all the different ways in which data could be displayed, thus allowing the analytics tool to be expandable in the future (Rose *et al.,* 2017).

The second stage was implementation which involved a number of technical challenges including improving my knowledge of AngularJS and NodeJS. I have gained a lot of experience learning new languages and thus I rose to this challenge well. Some of the main challenges however were centred on learning AngularJS. Firstly, dynamic applications do not perform efficiently - particularly large and complex applications (Ramos *et al.,* 2017). I overcame this problem by using lazy loading which improves the efficiency of a site by holding off initialising an object until it is needed. Secondly, it was challenging to divide modules into submodules due to AngularJS being a “Superheroic JavaScript MVW Framework” (Shahzad, 2017). This means it is a single page scripting language for loading all data dynamically. I solved this problem by creating directories based on archetypes rather than objects.

I completed the above work as part of a work-from-home internship due to COVID-19. Having previously experienced Exterity’s office environment, I am able to reflect upon some of the positive and negative aspects of working from home. One benefit was being able to define my own work schedule. As I tend to work best when starting slightly later in the day, I was able to adjust my hours to suit. Another benefit was the time and money I saved from not having to commute to the office every day. Working from home did however require more self discipline as it was very easy to be distracted by other activities. Thus more effort was needed to stay focused and get my work done. When you work from home your working day can also seem never ending. Since I would start and finish in the same place I found I would sometimes work later into the evening and not realise what time it was. Therefore once I had decided my working schedule, I made sure to stick to a strict routine in order to maintain a good work life balance.

Reflecting upon my experience working for Exterity, I have evaluated the areas of my internship that have been a success and highlighted areas that I can improve upon in the future. I need to improve upon my technique at interview stage by creating a portfolio that caters to the job specification. My user experience prototyping skills could be improved when I am asked to present a proposal for a project. I have however successfully developed key skills in prioritisation, technical skills in AngularJS and NodeJS, and learnt from the benefits of the Agile Development methodology. I will continue to improve upon the wide range of skills I have acquired during my time with Exterity as I seek to continue improving my Software Engineering skills in industry.

**References**


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Grant Prophet

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