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Capstone Internship at PNC

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# Introduction to PNC and Enterprise Technology and Security

This summer I had the opportunity to intern at PNC, one of the nation’s leading financial services institutions which started right here in Pittsburgh. They have now grown to roughly 2,000 branches spanning operations into 27 states. Spending time at PNC provided me with a unique experience in interacting with both banking and technology. PNC’s technology department is divided into two separate divisions, the division I worked within was called Enterprise Technology & Security or ET&S. They were known as the foundation that all of PNC’s technology was built upon, practically speaking they handled the backend technologies at PNC. Over the course of the internship, I had the opportunity to work alongside other professionals on real-world projects that had a real impact on two separate teams within ET&S.

## ET&S Advanced Analytics

The first team I was assigned to was ET&S Advanced Analytics. I was on this team with one other intern. The team was formed roughly one year before I arrived at PNC with the main purpose of setting up a new dashboard for ET&S’ CTO Debbie Guild. The dashboard was named Hot 100 as it contained 100 metrics that Debbie Guild leveraged monthly to communicate with PNC’s CEO Bill Demchak. A portion of my responsibilities this summer were directly related to this dashboard, tasks I will discuss later, however at a high level it involved bug fixes, metric reworks, and data cleansing. However, our main responsibility was an overarching project for the 10 weeks which involved reworking an OKR (Objective Key Results) reporting process for the Strategic Insight and Value team also known as SI&V. SI&V had two interns on their team who merged with our team’s interns to create a team of four for this project. As a team of four, we were given full ownership of this project and were completely responsible for the creation of the process. I will talk later in this paper about how it was done.

## DevOps Policy as Code (PaC)

The second team I worked for was a team part of the DevOps department within ET&S called PaC or Policy as Code. Policy as Code’s main role was informing and enforcing policies on software projects of a certain size and assisting in setting up the CI/CD pipeline that PaC monitors. All interns within PNC are assigned to a mentor who has previously completed an internship and is still working at PNC. My mentor was a member of this team and after hearing him discuss his work and what their team responsibilities encompass, I reached out to see if they had any work I could take on. I was given certain tasks and the ability to shadow my mentor in meetings which allowed me to learn a lot. Later in the paper, I will discuss my responsibilities.

# A group of people standing in front of a large screen Description automatically generatedAdvanced Analytics Responsibility & Project

**Figure 2A The Team of 4 interns**

## OKR Reporting Process

The OKR reporting process was previously being done in Tableau and Excel completely manually by the SI&V. PNC was pushing for wider implementation of OKRs for teams across the bank to better track progress and create more efficient budgeting and effort delegation. This push meant this process would need to be done more efficiently.

### Objectives & Motivations

The push for the expanded use of OKRs creates an obvious need to rework how things were being done. Having data providers input data into the same Excel document with no control over where/what they can edit is far from optimal. This manual input into Excel also required a manual upload of this data into Tableau. The current process was not scalable and would be a bottleneck with many weak points in terms of security. The first step was creating a more efficient and secure way to store the data and allow for input through a form. Ideally, data providers are only able to input data on how the metrics within their segment are performing and not be able to edit anything else without an approval process.

The process also had to be moved out of Tableau, Tableau licensing is not only required for the people building/editing the current dashboard, but a Tableau license is also required to view the dashboard. Each provision of a viewing license for Tableau was very costly. Everyone currently working at PNC is given a Microsoft license which includes PowerBI this means by transferring to PowerBI you’re saving a large sum of money.

Next, SI&V also had to manually chase data providers for their data. The current process was using manual email writing for deadline reminders, input access provisioning, and past-due data requests. This created the last key objective for us of automating the emailing and access provision of the process.

### Implementation

To implement the Hot 100 Dashboard our team used a stack that included a PowerBI dashboard backed by a SharePoint List that stored the data. The expectation for our OKR Dashboard was to implement it using the same tech stack. However, before beginning any of this the data must be pulled from Tableau and uploaded to SharePoint. To accomplish this I used SQL to query the data that was being used from a database and the rest was provided in one big Excel sheet. Once the data has been gathered our team of interns used Python to better structure this data in columns that would make the upload to Sharepoint much easier. This was required because when you upload data to Sharepoint the columns of the data must match the columns that are present in the separate Sharepoint lists.

Once the data was structured, the Sharepoint list had to be created. This is very similar to the process of creating database tables where each table holds certain attributes and number of rows. In terms of this process, 3 separate lists were created: Metric Directory, Intake, and Target history. Metric Directory stored general static information about metrics, intake acted as a running history, and where each months inputted data would land. Lastly, the Target history would store the history of the target of those OKRs. I found it to generally not be the best tool we could have used on this project as it is not a proper database. I will dive further into the problems with SharePoint being used in this fashion later in the paper.

A computer screen shot of a computer

Description automatically generatedOnce the data has been uploaded and all the lists populated within SharePoint the process of building out the dashboard begins. This task was divided between one other intern and I while the other two members worked on documenting the project so far in preparation for the transfer of ownership at the end of the summer. PowerBI has fantastic integrations for live data connections to power a dashboard. This is especially true for Sharepoint lists due to the fact they both fall within the Microsoft suite. Once the data is pulled into PowerBI the data can be manipulated in Microsoft PowerQuery functions, these functions will run every time the data connection is refreshed so you only have to do it once and allows for the creation of different calculated columns for the analysis. I am unable to speak about the different calculations we used for the analysis, but you can reference Figure 2A of the production dashboard below to get a general idea of what was done. Roughly 3 weeks were spent on building out the logic for the graphs in Python & DAX, these code lines can get very complicated or can be very simple. It was fulfilling to think out the logic of some of the more complicated tasks on the dashboard and was generally more enjoyable than at first glance.

**Figure 2.1.2A. OKR Dashboard built in PowerBI**

Once the dashboard was completed the next step was automating certain tasks. These automations were done in Power Automate using what are called “workflows”. The first task that was automated was the initial email that data providers received informing them that the intake period had begun for their OKR metrics. This involved referencing the SharePoint list to pull data provider information and reference it to their Microsoft account so that 1. Access can be given for the Intake period and 2. They receive an email in Outlook that informs them that the intake period has begun. The second automation I completed was the deadline reminder which was similar to the previous workflow but would just be sent out 1 day before the due date, on the due date, and every day after the due date.

### Technical Challenges

One of the major technical challenges that I referenced earlier in the paper was the use of SharePoint for data storage. SharePoint lacks a lot of the things that make relational databases as powerful as they are. SharePoint does not allow for primary keys, foreign keys or practically referencing another table in any way, and constraints. This created concerns for the other interns and I as for long-term storage of metric information the lack of these tools means bug fixing and data management of this list would be very challenging. Although we raised these concerns, we were asked to continue building out using SharePoint.

Another technical challenge was learning PowerBI. Before my time at PNC, I was not interested in data analysis in any way so learning the ins and outs of a data analysis platform like PowerBI was difficult. I lacked the personal motivation to push myself to learn data manipulation, creating efficient visualization, and other tasks related to data analysis in PowerBI. However, when working with PowerBI in a practical business setting I found the motivation to push myself and create more complicated visualizations within PowerBI and eventually overcame this challenge.

### Non-Technical Challenges

The only non-technical Challenges I faced were with contacting SI&V about their current process. The interns lacked access to view the current process/dashboard so communication about the current reporting process within Tableau had to be done through a SI&V team member. We found that it was very hard to get in contact with a member who had time on their schedule to speak with us and help us build out certain tasks. This led to tasks being blocked for multiple days and leaving some portion of the project at a standstill.

### Outcome

Once the process was complete and user-tested we were able to implement it for the August reporting month. Now my internship concluded on the 4th of August but everything up to the point was operational and in deployment. I was able to contact a member of my team recently who informed me that the process has been in deployment ever since then and while there were occasional bugs everything is working as it should.

#### Business Impact

At the end of the project with the rest of our team, a cost analysis was performed to determine the business impact of the process rework. The cost analysis yielded that the process rework saved roughly $10,000 yearly and ~140 hours of work. This was a very rewarding portion of my internship because I felt there was a tangible impact I had at the company and an end-to-end deliverable.

## Hot 100 Dashboard

Another responsibility I had on the team was doing daily work around the team’s main product, the “Hot 100 Dashboard”. At the beginning of the summer, my tasks concerning the dashboard were mainly data cleansing. This required us to monitor the SharePoint list that was holding the data and make sure that no data was formatted incorrectly. Once I gained more experience, I was able to expand my responsibilities to handle some of the logic within the dashboard and even assisted the teams in automatic data validation before the data was loaded into SharePoint to reduce the need to constantly monitor the lists. This is something we implemented in our OKR process. I assisted certain team members in a pair-programming type of way to work with some of the dashboard logic.

## Centralized Analytics Platform

The OKR process project was completed ahead of the planned timeline for our summer, thus the team brainstormed a new project for us to work on. They landed on an application that would act as a centralized hub to house the different products the Advanced Analytics team had ownership of. Currently, this was only a few dashboards but as they expanded into more data, they would have a place where leadership can come to view the different dashboards in one place. Also, data providers tend to have overlap on multiple dashboards so having a centralized place for data intake would allow them to have one place to navigate and input all their data. Another request was to have a place where anyone can self-service the static metric information. They originally requested that the app be developed in PowerApps. During the development process, there were daily UI/UX reviews where we would move through the app and talk about how the key tasks were being represented thus far. Also during these UI/UX meetings, we would have random people around the bank review the setup of the app and how easy it was to find things. This allowed us to develop very quickly as we were receiving daily feedback and recommendations. Towards the end of my internship, the asks for the app became very complicated and the interns convinced the team to generate a web application. Due to this being towards the end of my summer, our contribution to the web application was minor.

# DevOps Policy as Code Responsibilities

## Mnemonic Software

As I discussed previously, PNC has a policy for software that if they reach a certain user size and/or data accesses they must create what is called a mnemonic. This means they are assigned a short string of characters that identifies that software however the mean piece of the mnemonic policy is that they fall under certain change management policies and policies related to their containerization.

My main responsibilities included assisting my mentor in attending meetings for new software projects that fall within this policy and require consulting in setting up tests for these policies. This gave me valuable experience in technical communication and learning about enterprise testing environments on a large scale. I was able to assist in connecting the software’s CI/CD pipeline to RedHat and assist them in crafting tests related to the policies. Previous to this I have not had any exposure to containers and how that works in a large company, and it was a great learning experience to be exposed to.

## Dashboard Analytics

Jenkins allows for data to be pulled from the various implementations. RedHat allows you to hit these data endpoints and create live dashboards. After my mentor heard of my main team’s experience with crafting dashboards, he asked if I could attempt to create a RedHat dashboard. In my opinion, this was much more challenging than PowerBI. I was not able to fully complete the dashboard before my internship, but I did have a simple one up and running for the team.

# Conclusion

Overall, I found my internship at PNC to be a very valuable learning experience. My biggest complaint was the lack of information coming into my internship; I had no idea what team I would be working on or what I would be working with until the first week of the summer. I believe they should split their internship out into interest because I am not interested in data science but ended up doing that for 10 weeks. I would say it has made me enjoy data science more, but it also made me realize that I do not want to do that for a career. PNC had some of the most welcoming people to work with and I was pleasantly surprised by the number of activities and happy hours we did as a team. Everyone I interacted with cared about my growth and learning and was very understanding when it came to work-life balance. I was able to become friends with almost everyone on my team outside of work which I still talk to today.