BNP Paribas: Data ETL for Key Performance Indicators to Improve Prime Brokerage Service Levels

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Abstract

The Prime Brokerage team at BNP Paribas is looking to strengthen its client services by centralizing the key performance indicator (KPI) data related to the services it offers. Prime Brokerage is a competitive market and BNP Paribas must keep its clients satisfied. To do this BNP wants to create a dashboard that contains the complete picture of the performance of its Prime Brokerage Platform. To help them accomplish this, we designed and wrote software to extract data from multiple APIs, transform it, and then load it into a central data mart.

Acknowledgments

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Without the support of these individuals, our project would have not been possible to complete as we are experiencing an unprecedented time during the COVID pandemic. Thank you all for your contributions to make this project valuable.

Executive Summary

BNP Paribas is the largest banking group in the European Union. As of March 2020, BNP has expanded into 71 countries employing around 199,000 staff. Its largest presence is in Europe and the United States. Its primary focus is on retail banking and services along with Corporate and Institutional Banking (CIB).

BNP is a top prime broker in the U.S. and plans to stay one. Some of its operations as a prime broker include financing securities for hedge funds, serving as a broker-dealer for clients, cash management, and interacting with clients directly through platforms. BNP wants to better understand how its prime brokerage platform caters to its client's needs on a daily basis regarding service level agreements (SLAs). It understands that its clients are seeking the best service possible and will leave to do business with other prime brokers if they are unsatisfied with the services being provided. Management wants to keep repeat business with clients and ensure that its current ones are pleased by dealing with any issues that arise when using its services.

The goal of our project was to help BNP strengthen the prime brokerage platform's client services. We were tasked with extracting important KPI data from several APIs such as an internal client issue tracker, Jira Issues, and ServiceNow Incidents, then transforming and loading the data into a data mart. With all this data, BNP plans to expand on a dashboard that will help the Prime Brokerage team monitor problems that occur and improve its customer's overall experience with the company.

Throughout our project we faced many issues getting access to the services and software that we needed to complete all the defined goals. The scope of our project was narrowed to integrating only Jira as we were unable to get access to the client issue tracker during our project term and we did not get access to ServiceNow until the final week of our project. We were able to maximize our productivity by holding daily scrum meetings and using Agile sprints to organize and continuously improve our project which led to the successful integration of Jira.

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1. Introduction

BNP Paribas is the largest French banking group as well as the biggest bank in the European Union. As of March 2020, BNP has expanded into 71 countries employing around 199,000 staff. Its largest presence is in Europe (where it is headquartered) and in the United States (BNP Paribas, 2016b). As of 2019, BNP has earned the title of “Top Employers Europe label” due to their exceptional work conditions and ability to develop their employees, which allows them to qualify for this accomplishment since they have at least 5 different certifications in different countries (BNP Paribas, 2019a). They are ranked a top 10 bank throughout the world and second biggest in Europe with its assets totaling 2.4 trillion dollars or 2.03 trillion euros. Its primary focus is on retail banking and services along with Corporate and Institutional Banking (CIB). Its network in Europe consists of 4,150 branches and serves around 15 million clients, 268,500 private banking clients, and 176,000 corporate clients (BNP Paribas, 2019a). BNP is always looking for innovative ways to further grow its business by keeping up with competitors in its industry with the latest technology, and by satisfying its customers' needs.

BNP is a top prime broker in the U.S. and plans to stay one. Some of its operations as a prime broker include financing securities for hedge funds, broker-dealer for clients, cash management, and interacting with clients directly through platforms. Senior management wants to better understand how its platform caters to its client’s needs on a daily basis regarding service level agreements (SLAs). It understands that its clients are seeking the best service possible and will leave to do business with other banks if they are unsatisfied with the services being provided. Management wants to keep repeat business with clients and ensure that its current ones are pleased by dealing with any issues that arise when using its services.

BNP is looking to strengthen its client services using data analytics by creating a dashboard that tracks the Prime Brokerage Platform’s key performance indicators (KPIs) related to the services it offers. Since it is in such a competitive market, it must keep its clients satisfied, especially its tier-one clients with its services. To get a complete picture of the performance of the Prime Brokerage Platform additional data sources needed to be added to one common data mart for the dashboard to load data from. The dashboard will generate scorecards of customers that will monitor problems that occur, both client complaints and internal KPIs. This system's main goal is to improve its customer’s overall experience with the company. The data for this dashboard will come from an internal client issue tracker, Jira Issues, and ServiceNow Incidents.

2. Background and Research

2.1 BNP Paribas

BNP Paribas was originally established in Paris, France, and began to grow in the early 19th century during the industrial period in Europe (BNP Paribas, 2016a). It contributed to the second banking revolution which involved the necessary savings to finance growth in the economy at the time (BNP Paribas, 2016a). Before the name BNP Paribas, its forerunner was pioneer Société Générale de Belgique, which was founded in Brussels in 1822. BNP was one of the first banks to develop mixed banking by merging retail banking with shareholders in companies (BNP Paribas, 2016a). Later in 1848, France encountered a political revolution and economic disaster. That same year, critical action was taken by public authorities along with private interests to start discounting houses ("comptoirs d'escompte"). This led to the emergence of two banks (Comptoir National d'Escompte de Paris (CNEP) and Comptoir National d'Escompte de Mulhouse) that would eventually combine to make BNP (BNP Paribas, 2016a).

The birth of BNP came about in 1966 and was the new French Leader in banking (BNP Paribas, 2016a). At this time in history, banks were actively involved in society, in particular for women and younger people. The following year it was involved in the launch of the "carte bleue bank card" which helped the bank become more recognized since it was the first form of payment through card in France (BNP Paribas, 2016a). Following political changes in France, BNP's leader Michel Pébereau built a group that would eventually be leaders for strong risk control, new alliances, and modern banking tools in France. Shortly after in 1999, BNP purchased a stake in Paribas and established the "BNP Paribas group". In 2000, leaders at BNP had the vision to create a truly European banking group for careers to prosper. The group accomplished this by growing its presence by partnering with groups in Turkey, Italy, Belgium, Luxembourg, Poland, and Germany (BNP Paribas, 2016a).

When the 21st century arrived so did the digital age for the banking industry. This obstacle was overcome in 2013 with the creation of Hello bank for mobile users (BNP Paribas, 2016a). As the banking industry evolved so has BNP Paribas to meet consumer demand and it has shown through its earnings over the years. As of 2019, it has 2.16 trillion (Euros) in total assets. Revenue for that year was just under 45 million euros, an increase of 2.5 million euros from the year prior (BNP Paribas, 2019b).

BNP Paribas more recently has been more involved in supporting fintech ventures and supports many young innovative entrepreneurs pursuing this path. Its involvement has been directly linked to the bank's digital evolution (BNP Paribas, 2019c). Fintech has opened many outlets and helps them offer the latest products and services for its customers, giving it an edge over its competitors (BNP Paribas, 2019c). The group has a plan in place with fintech that is based around four pillars. These pillars are access to banking services, co-creation, acceleration, and investment (BNP Paribas, 2019c). Its first pillar of access to banking services is to support start-ups with their development not only in France but globally (BNP Paribas, 2019c). Next, co-creation of new solutions for its customers, to enhance their services for a better experience

(BNP Paribas, 2019c). Acceleration is helping startups further develop and this approach is examining new technologies, meeting the requirements of businesses to improve customer experience, it offers different opportunities to explore and gives more opportunities for employees to work differently. Lastly, it invests in fintech start-ups through a variety of different ways, some being directly through acquisitions, equity interests, or even indirectly (BNP Paribas, 2019c).

2.2 Prime Brokerage

A prime brokerage account is an important opportunity for business and revenue for many investment banks and other financial institutions (Chen, 2020). The word “prime” references a large financial institution that provides its assistance to established clients or hedge funds (Prime Broker, 2020). The term “brokerage account” is a type of investment account that supports a person or business to buy and sell a range of investments such as bonds, stocks, mutual funds, and Exchange-Traded Funds, ETFs (What is a Brokerage Account, 2020). A prime broker provides and services a single or main account for hedge funds which contains all of their cash and securities (Chen, 2020). Other services offered by a prime broker are cash management, reporting, and lending (Chen, 2020). In return for their services, they charge a fee, and this is how they make their money. Prime brokers and hedge funds spend time analyzing each other to see if their investing strategies match up, if they offer and use similar services, and if they have suitable levels of risk for each other (Eren, 2015). The two sides have a trading relationship with one another due to the benefits of specialization (Eren, 2015). Specialization assists with internalization, which allows the process to be completed within the company, which permits a prime broker to be more time-efficient when placing orders for clients or locating their securities by utilizing other clients’ orders and securities (Eren, 2015). For a prime broker to be successful and to attract business they must have up-to-date technology and application that has real-time reporting capabilities, a high-quality trading platform that is easily accessible for their customers, competitive pricing, and have quality security and risk policies established (Prequin, 2020).

2.3 Service Level Agreements

Service level agreements are an important part of the business world when purchasing or outsourcing services to another company. These service level agreements, also known as an SLA, make sure that what you are buying is up to your standards and costs. An SLA will typically specify the services you will receive, clear standards of those services, costs of the services, and the consequences of not achieving those standards (Desai, 2010). SLAs are most commonly used when services are long-term, high value, complex, or business-critical, and the precision of such a document is needed.

In more specific terms there are four areas relating directly to your service itself in the agreement. There is the service, the measure of service known as the service level, the target required to achieve that level known as the service level target, and the amount of reimbursement owed if the target is not met known as the service level credit (Desai, 2010). A common use of

SLA is for cloud computing in which a company's entire online infrastructure may be hosted by another business. In this scenario, the service would be providing servers of a specification to run software on. The service level may be uptime per month and a daily server status report deliverable. The service level target might be 99.5% uptime every month with a daily report by 6 pm. Lastly, the service level credit could be assigned to a team of engineers to fix the problem immediately and if the service level drops below 98.5% then a large credit is issued for the month. Breaches of service levels could also have much more complicated compensation plans, ranging from large monetary sums to forcing a team to be assigned to fix the problem to even a possible annulment of the agreement (Desai, 2010). Because of the amount of money typically at stake for the customer in the case of breaches of an SLA the provider must work very hard to avoid these mistakes and fix them quickly if they happen as in the worst-case scenario a customer can take them to court over breaches.

2.3.1 Key Performance Indicators

Businesses must know how well they are performing at all times and the most efficient way to know that is through key performance indicators. These key performance indicators, also known as KPI, help a business see at a glance how well they are doing in relation to their goals. KPIs provide several objective and manageable indicators that can be used to see what needs to be worked on to improve the business (Marr, 2015). These KPIs can be used to measure the same service level targets to provide information on how well your company is meeting the targets set out in your SLA. Examples of some common KPIs regarding SLAs are the terms of your SLA agreement. For example, if you had a clause stating incidents must be resolved within 10 hours of being reported, you would have a KPI that measures incident resolution time and tracking whether that ever exceeds the 10-hour threshold.

2.4 Similar Applications

The ETL (Extract, Transform, and Load) architecture has been a common way to map many data sources to a single data mart. The ETL process is important because it ensures that all the data being loaded into the data mart will be validated and cleaned, which will make the dashboard easier to create.

Many applications exist to help visualize your KPIs, but these require you to have your KPIs already created and measurable. Many different software options let you do these visualizations such as Tableau, Power BI, Scoro, Datapine, and more. The biggest drawback to these visualization applications is that they require you to decide what KPIs you need to measure and to figure out how you are going to get the data to calculate these values.

Currently, BNP uses Tableau for its KPI visualization but would like to switch to using Power BI. While both similar in what they provide, Power BI is created by Microsoft and thus interfaces very well with the Microsoft ecosystem that BNP seems to be using. Tableau on the other hand has a bit more difficulty interfacing with the Microsoft ecosystem but interfaces with more and a much larger variety of services to pull data from.

3. Methodology

3.1 Agile and Scrum

Agile project management is an adaptive software engineering paradigm that focuses on iterative development, self-organizing teams, and continuous improvement. This type of approach to projects ensures that a project team consistently delivers products. Agile also incorporates customer feedback so the development team can get continuous feedback on the product throughout the development process. The Agile philosophy is implemented through Agile frameworks such as Scrum and Kanban (Rubin, 2012).

Scrum is a popular agile framework that has a set of meetings, tools, and roles that help teams self-coordinate and manage their work. While Agile is a mindset and philosophy, Scrum is a framework that defines how a team of usually less than 10 people should get work done. Scrum uses short release cycles called sprints to help teams to adapt to changing user requirements and constantly manage changing priorities. Work is broken down into epics and user stories. Epics are a high-level overview of a unifying objective which are made up of smaller user stories that are tasks that are to be completed in the timeframe of a sprint. Scrum has three main components: artifacts, ceremonies, and roles (Rubin, 2012).

Scrum Artifacts provide key information into what work the Scrum Team needs to accomplish. Here are the three main Scrum Artifacts:

- Product Backlog: Master to-do list of all the work the team needs to accomplish.
- Sprint Backlog: List of user stories that are to be implemented in the current sprint cycle.
- Increment: Usable end-product developed at the end of each sprint.

Scrum Ceremonies are sequential events described by the Scrum framework that the Scrum Team must perform. This is the most customizable part of the Scrum framework where each team can determine which events they want to focus on. Here are all the ceremonies:

- Sprint Planning: The Scrum Team determines the scope of the current sprint and what user stories are going to be added to the sprint backlog.
- Sprint: The sprint is the timeframe in which the Scrum team works to develop an increment. All the listed ceremonies take place during a sprint. A sprint usually lasts one to two weeks.
- Daily Scrum: Daily short meeting run by the scrum master where each member of the team answers three questions:
    1. What did I do yesterday?
    2. What do I plan to do today?
    3. Are there any obstacles?
        - The scrum master is responsible for removing any obstacles.

- Sprint Review: At the end of a sprint the development team presents the increment developed in the sprint to the team. The goal of this is to get feedback on the latest product. User stories in the sprint backlog that were not finished are added to the product backlog. Velocity and burndown charts are created to track the progress of the team over many sprints.
- Sprint Retrospective: The whole team comes together and discusses how to improve the team by reviewing what worked and what did not work in the sprint.

Scrum Roles consist of three cross-functional roles that each have critical tasks.

- Product Owner: Responsible for managing the product backlog, understanding customer requirements, and prioritizing the team's work.
- Scrum Master: Organizes and facilitates all the ceremonies and makes sure the team is properly following the Scrum framework.
- Development Team: Members of the team usually have a variety of skill sets working on the product.

Flow of Events

1. Product Backlog is Created
2. Sprints Start
    a. Sprint Planning
    b. Development Starts
    c. Daily Scrums (repeated every day throughout the sprint)
    d. Development Ends
    e. Sprint Review
    f. Sprint Retrospective

3.2 Traditional SDLC Waterfall Development Model

The Waterfall Development Model is a linear approach to the software development process such that there are set stages of a project that take place sequentially making it easy to understand. Each stage must be completed before the next stage can start. The Waterfall method was very popular before Agile as it is easy to manage and has clearly defined stages. Here are the phases of the Waterfall method:

- Requirements Gathering and Analysis: All the requirements for the project are documented and analyzed.
- Design: The overall system architecture is created.
- Development: The software is developed, usually in small units that are integrated at the end of development.
- Testing: The team addresses any bugs or system flaws, and the software is verified to meet the client's requirements.

- Maintenance: Issues or changes may need to be addressed after the software is deployed to the client.

There are many disadvantages to using the Waterfall development model mainly revolving around the lack of revision during development and testing. If there is a flaw in the system architecture the whole project may need to be overhauled (Futrell et al., 2002).

3.3 Methodology Selection

The Agile methodology is the best choice for our project as it is suited to handle the potential volatility in the requirements of our project. The business and technical requirements of our project are not clearly defined and understood and are subject to change throughout our project such that the Waterfall methodology would not allow us to react to rapid changes. Agile will give us the platform to constantly reevaluate the design and requirements of our project.

We used the Scrum framework to manage our project as our team members have had previous experience with both and both will provide an excellent framework to manage the project. The project management software we decided to use for our project had a scrum integration that made it easy to manage.

3.4 Business and Project Risk Management

3.4.1 Risk vs Reward for Project

For our project we worked with the Prime Brokerage Division at BNP, specifically, their KPI team that is focusing on SLAs and tracking down issues that their clients encounter. Since BNP is a leading bank in a competitive environment, many of their clients are sensitive and will choose competitors if they are not satisfied with the bank. Therefore, it is imperative for this project to successfully track BNP's internal KPI to keep their clients satisfied with their services.

If this issue was not being examined, BNP risks losing valuable customers, especially their tier-one customers (larger equity businesses) if they do not meet their SLA requirements. This would have a direct impact on their company revenue now and in the future, if they lose their repeat customers. However, if this project is successfully executed, it can help increase the bottom line for BNP in a few ways. The first is that it will retain customers and attract new ones by offering a top prime brokerage service to its clients. Secondly, it will decrease the cost that the company incurs by not having to spend additional resources in managing SLA breaches.

Even with this pandemic occurring, BNP's prime brokerage division has not been affected. In fact, they plan to bring "Deutsche Bank's hedge fund clients onto its prime brokerage platform, as well as its electronic execution technology" (Parsons, 2020). With the integration of Deutsche's business, they hope to emerge as a top prime broker globally. This project will put them in the right direction and help them obtain this goal by better meeting their clients' needs and identifying issues early, specifically with their SLAs.

3.4.2 Risk Culture

Risk culture at BNP has set a standard for our team and the project. The risk mitigation taken at the company is very strict and sets the tone for all employees that work there. Since BNP is such a large, well-known global bank with many divisions, they have protocols that one must go through to access information. This prevents any breaches from external people/organizations and from within the company. On top of the tight security measures to gain access, BNP monitors all ingoing and outgoing mail from their servers. This experience has made our team learn that at big banks or major corporations, they must take certain measures to protect their clients’ information from being mishandled or accidentally exposed. With all these secure procedures, getting granted access has become a harder and longer process, especially working remotely. With a company this big, it takes time for software and tools to be given access, especially when there is a time zone difference from one place to another. This is just another example of the culture at BNP and how it takes extreme security measures.

4. Software Development Environment

Our project requires many development and project management tools to organize both the project and the team. These tools were critical to our project and development process to allow us to work efficiently and effectively.

4.1 Project Management Software

To manage a project of this size, multiple pieces of software were needed to fill different types of roles and manage different things. Major pieces of software that we used include collaborative writing software, communication software, agile project management software, and code management software with git version control. These pieces of software will allow us to be more structured and organized in our work.

4.1.1 Google Drive

We used Google Drive to organize all our files throughout the project, along with Google Docs, Google Slides, and Google Sheets. The main reason we chose the Google Drive Suite is that it allowed us to synchronously work on reports, presentations, and other project documents even while remote. While alternatives such as Dropbox and the Microsoft Suite provide similar features, they are not as well integrated as the Google Drive Suite.

4.1.2 Slack

Slack was used as the team’s main way to communicate. Slack provided us with a convenient way to message everyone on the team or communicate directly with another team member and also has a mobile and desktop app. Compared to its alternatives such as GroupMe and Microsoft Teams our team has had more experience and was more comfortable with Slack. We selected Slack because of our increased experience with it, it was free for our uses, and because it could create channels to help organize our work better.

4.1.3 Jira

To assist the team in using the Agile and Scrum frameworks we used Jira to keep track of our tasks. Jira allowed us to graphically organize our tasks into the backlog or in a sprint along with the stage of the task such as to do, in progress, or done. Jira was also one of the tools that our sponsor uses to track issues so by using it for our project we were able to gain further experience with the software. We selected Jira because our sponsor was using it so we could get more experience by using it ourselves and we could interface well with their systems.

4.1.4 Bitbucket

To store all the code for our project, we used Bitbucket which allowed us to set up a version control repository. Having a version control repository is required for nearly every software project as it prevents concurrent and conflicting changes to code while tracking all code changes. Bitbucket is integrated with Jira which we were already using for our project and our sponsor was already using. Other popular alternatives exist for this such as GitHub and GitLab but we selected Bitbucket because it was what BNP was already using as their version control system and we had to work within their network, making it the only option.

4.2 Integrated Development Environment

To edit code for our project we used Visual Studio Code (VS Code). VS Code is currently ranked the most popular development environment tool by developers as it offers out-of-the-box support for the most common programming languages and its ability to easily install new extensions. VS Code has extensions for Python and all SQL variants which allows us to develop all our code in one place. In addition, it also has integration with git to help manage our code easier. Although VS Code is not a complete integrated development environment and is more akin to a large featured text editor, it suits our needs better for developing scripts and other smaller programs as opposed to large software projects that IDE's typically handle better. While other feature-rich text editors exist such as Atom, Vim, Emacs, and Sublime, VS Code was the one that our team had the most experience with and is also free to use.

4.3 Software Tools/Programming Languages

Throughout our work, a variety of programming languages and software tools were used to create our final project. These tools range from different relational databases, to data visualization tools, to programming languages and packages. While some packages were chosen by the team, most of the tools and languages were dictated by BNP based on what they currently used or wanted to be used for specific tasks.

4.3.1 Microsoft SQL Server

A popular choice for an enterprise-level relational database, Microsoft SQL Server is a relational database created and maintained by Microsoft. While similar to other relational databases there are a few key differences. Instead of using standard SQL to query the database, MS SQL uses Microsoft Transact-SQL (T-SQL) to manage and query the database. Again, like other variants of SQL, there are a few syntactic differences such as data types and keywords (*SQL Server technical documentation*, 2020). A major benefit of MS SQL is that since it is created by Microsoft it integrates very well with Microsoft Azure allowing companies to have Microsoft manage its servers and scale its database on demand. It also integrates well with other products in the Microsoft ecosystem such as Power BI. MS SQL is used by 98 companies of the Fortune 100 showing its reliability with enterprise-grade customers (*Microsoft Data Platform*, 2020). Though there are other popular alternatives for relational databases such as MySQL, PostgreSQL, and more, BNP already uses MS SQL as one of its current relational databases.

4.3.2 Oracle SQL

A different but equally popular choice for an enterprise-level relational database is Oracle SQL. This relational database is created and maintained by Oracle and can even be hosted by Oracle for prices cheaper than AWS (*Oracle Cloud Infrastructure*, 2020). As with Microsoft SQL, there are slight syntactic differences in Oracle SQL compared to other variants of SQL that include data types, keywords, and even some functions. One of the most powerful features of Oracle SQL is its ability to use PL/SQL and Java as extensions to SQL. These stored subprograms add a deep layer of extensibility to Oracle SQL (*SQL Language*, 2020). BNP currently uses Oracle SQL in addition to the previously mentioned Microsoft SQL Server as one of their current relational databases.

4.3.3 Python

Python is a powerful interpreted high-level programming language used in many different industries from big projects to small scripts. It emphasizes code readability with lots of whitespaces which helps make it easy to develop programs quickly. BNP currently uses Python for their systems already so we decided to use it as it would integrate well, and we have experience with it before.

4.3.4 Python Packages

A central functionality of our Python program is to query the Jira API. This was done by sending HTTP GET and POST requests using the Python Requests library. This library allowed us to easily send HTTP requests and process the results quickly into JSON. Once we had the data it then needed to be sent to an MS SQL database which we did using the Pyodbc library. Pyodbc is what Microsoft recommends using to connect to MS SQL databases from Python (*SQL Server technical documentation*, 2020). It allows you to make connections with databases through an ODBC driver which allows you to perform any SQL operation on a database.

4.4 Data Sources

BNP's current dashboard needs to incorporate a multitude of data sources to successfully provide the user with all the information they need in one centralized location. To this end, we incorporated new data sources into the central KPI data mart to in turn feed the dashboard. While the most important data source would have been the client issue tracker, Jira and ServiceNow also provided useful information allowing much better analysis and interpretation.

4.4.1 Client Issue Tracker

The client issue tracker is an in-house solution created by BNP Paribas to keep track of all their issues reported by clients, specifically referring to any breaches of their SLAs. It resides on Oracle SQL databases. The client issue tracker would have provided the base set of information for the dashboard with which it could be extended.

4.4.2 Jira Issues API

Jira issues are a popular feature of the project tracking software Jira. These issues can relate to any part of the project and help track problems that are occurring. To retrieve this information, we queried a REST API that Jira provides to retrieve a list of issues needed (*Rest APIs*, 2020). These issues provided more information to extend the functionality of the dashboard and allow more insights from it.

4.4.3 ServiceNow API

ServiceNow is a large software platform used for tracking a large amount of information relating to projects and workflows within a company including incidents. These incidents provide more information that can be used to extend the functionality of the dashboard. To get this information we would have queried a REST API that ServiceNow provides for accessing all its information (*REST API reference*, 2020). ServiceNow provides APIs for accessing all parts of its infrastructure but we would have only accessed the incidents function.

5. Software Requirements

5.1 Requirement Gathering Strategy

Requirements should be established at the start of a new project. When using software, a software requirements specification (SRS) should be created (Lloyd et al., 2002 2002). The first thing that will need to be achieved for the SRS is discovering and understanding all the requirements that are needed to accomplish the team's goal. With that, it is just as important to assign roles to individuals on how each part is going to be completed. This was discussed and completed during meetings that the group held throughout the project (Lloyd et al., 2002 2002). Some topics that were spoken about during the duration of the project are the user requirements, analysis, prototyping, modeling, productivity, and walkthrough verification (Lloyd et al., 2002 2002). Lastly, it is important to recognize what key members your group will need to collaborate with directly to successfully achieve the project goal. Our group will need to work with the KPI Project team at BNP, specifically the project leader, and IT support.

Our team held meetings and collaborated, but there are many other effective strategies that we incorporated. Some other potential techniques that were used were the question-and-answer method, interviews, brainstorming, surveys/questionnaires, storyboards, and prototyping (Lloyd et al., 2002 2002). For this project, it is most important that our group recognizes which strategy is the most effective for the project. An area that is becoming more critical for our project and projects of the future is having the ability to work from multiple locations (Lloyd et al., 2002 2002). Having remote access to work essentially anywhere is ideal and setting up virtual meetings is critical for our group especially with the circumstances of the current pandemic.

5.2 Functional and Non-functional Requirements

The end goal of any project is to deliver a product that the customer needs. In doing so, it is important to know what the functional and non-functional requirements are for the software. A functional requirement identifies the fundamental components of the system being utilized and brings value to its user (*Functional vs Non-Functional Requirements: The Definitive Guide*, 2020). It points out what the system can perform and what it should not perform. After data is put into the system it will analyze and store it. It then must be able to have the capacity to respond to what was entered into the system (*Functional vs Non-Functional Requirements: The Definitive Guide*, 2020). Then it will produce an appropriate output. All of this can only be achieved if all the functional requirements are met and have all the necessary product features and focus on the user needs (*Functional vs Non-Functional Requirements: The Definitive Guide*, 2020). For our project, the functional requirements were defined with help from our coworkers and evolved over time. Listed below are the main functional requirements:

- Query Jira, ServiceNow, and Client Issue Tracker APIs.
- Automatically validate and load data from APIs into the data mart.

The other type of requirement that brings value to the system is non-functional requirements. This requisite, similarly, defines what the given system does and what it should not do but its main point of emphasis is to concentrate on how the system should accomplish it (*Functional vs Non-Functional Requirements: The Definitive Guide*, 2020). It also characterizes the systems most essential characteristics, other than functionality which are usability, reliability, performance, and supportability (*Nonfunctional Requirements*, 2020). It provides limitations for the system and if one of these is not met it can lead to malfunctions in the designed system since it will not meet the business', user, or the market needs (*Nonfunctional Requirements*, 2020). Its focal points are product properties and user expectations (*Functional vs Non-Functional Requirements: The Definitive Guide*, 2020). The easier a system is to use, the more effective its performance will be. Figure 1 displays the main focuses of both the functional and non-functional requirements. Listed below are the non-functional requirements:

- Our code should be able to perform the ETL process quickly and efficiently.
- Our code should be reliable and should not crash.
- Our code should be easy to update and maintain.

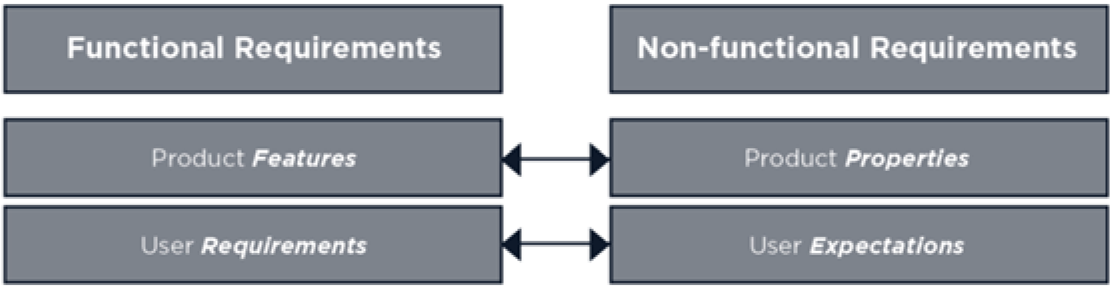


Figure 1: Functional vs Non-Functional Requirements
(Functional vs Non-Functional Requirements: The Definitive Guide, 2020)

5.3 User Stories and Epics

User stories and epics are tools that are applied in agile software development. The main objective of these features is to capture software features from an end-user point of view (*What is a User Story*, 2020). A user story is a simple description told from the perspective of a user who wants a new ability. The story is informal and describes a common feature that the software they are using offers. The user story intends to convey how the software will provide value to its end-user which is usually the customer. In addition, agile allows for user stories to change since companies and customers are continuously learning about systems as a project develops (*What is a User Story*, 2020). For a story to be complete there are certain elements it must have. It must be independent and allow for change to occur in an organization while incurring a minimal cost. Next, it must be negotiable or flexible based on the business' constraints and obligations. Thirdly, it needs to bring value to both the organization and the user. Lastly, it needs to be manageable enough to fit within a sprint and testable so it can be confirmed to be working. An epic is a large task of work that is composed of smaller tasks called user stories (Rehkopf, 2020). These stories and epics are recorded on project management software and viewed, added, and edited by the various stakeholders (*What is a User Story*, 2020).

Epic *1: Create a prototype that replicates BNP's current dashboard.*

a. As a user
   i. I want to have a similar dashboard experience to the previous dashboard to speed up my workflow
   ii. I want the dashboard to also be updated with data from Jira, so the dashboard provides more insight to me
   iii. I want the dashboard to pull data from an MS SQL server so that it can be continuously updated

Epic *2: Jira Integration*

b. As a user
   i. I want all relevant data fields to be available to me in the data mart
   ii. I want all data coming from Jira to be cleaned and validated to be usable
   iii. I want to know what data can be accessed from the Jira API
c. As a developer
   i. I want to get access to Jira
   ii. I want to be able to fetch data from the Jira API
   iii. I want data from Jira to automatically propagate from Jira to the data mart

Epic *3: ServiceNow Integration*

d. As a user
   i. I want all relevant data fields to be available to me in the data mart
   ii. I want all data coming from ServiceNow to be cleaned and transformed correctly to be usable
e. As a developer
   i. I want to get access to ServiceNow
   ii. I want to be able to fetch data from the ServiceNow API
   iii. I want data from ServiceNow to automatically propagate from ServiceNow to the data mart

Epic *4: Client Issue Tracker Integration*

f. As a user
   i. I want all relevant data fields to be available to me in the data mart

    ii. I want all data coming from the client issue tracker to be cleaned and transformed correctly to be usable

g. As a developer

    i. I would like to get access to the client issue tracker
    ii. I want to be able to fetch data from the client issue tracker database
    iii. I want data from the client issue tracker to automatically propagate from the database to the data mart

***Epic** 5: MQP Report*

h. As a student

    i. I would like BNP to review our paper for compliance issues
    ii. I would like our paper to be fully edited and revised.
    iii. I would like our paper to be correctly formatted
    iv. I would like our conclusions to be written
    v. I would like our future work to be written
    vi. I would like our assessment to be written
    vii. I would like our software development to be fully written
    viii. I would like our software design to be fully written
    ix. I would like our software requirements to be fully written
    x. I would like our software development environment to be fully written
    xi. I would like our methodology to be fully written
    xii. I would like our background and research to be fully written
    xiii. I would like our introduction section to be fully written
    xiv. I would like our executive summary to be written
    xv. I would like our abstract to be written.

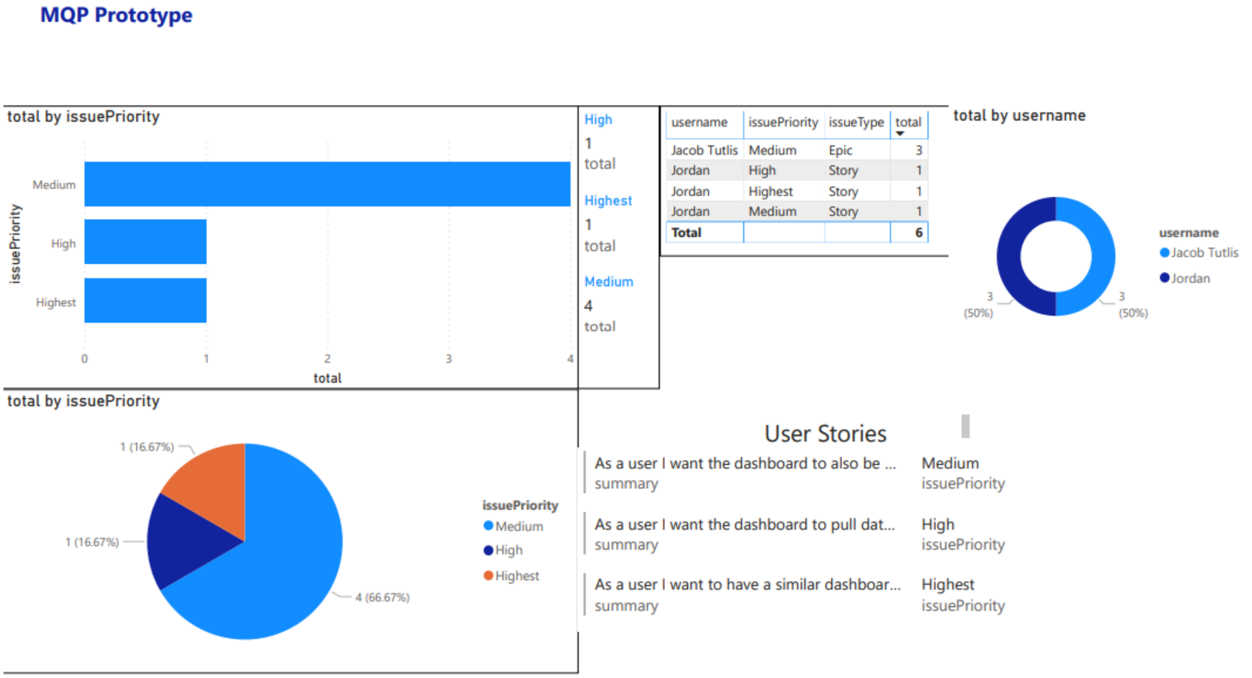
6. Software Design

6.1 Software Prototype

A software prototype was developed to increase our familiarity with the tools we would be using and to give us a solid starting point once full development was able to start. This prototype was created with our initial complete project scope in mind.

6.1.1 Interface Design

Our initial interface design, shown below in Figure 2, was very simplistic and designed mostly to familiarize ourselves with Power BI and the tools it offered. At this time, we did not know what the data we would be working with would look like or what BNP's current dashboard would look like.



username	issuePriority	issueType	total
Jacob Tutlis	Medium	Epic	3
Jordan	High	Story	1
Jordan	Highest	Story	1
Jordan	Medium	Story	1
Total			**6**

User Stories

As a user I want the dashboard to also be ... summary	Medium issuePriority
As a user I want the dashboard to pull dat... summary	High issuePriority
As a user I want to have a similar dashboar... summary	Highest issuePriority

Figure 2: Prototype Dashboard Interface

6.1.2 Architecture Diagram

Shown below in Figure 3 is the architecture diagram for our prototype. Our Power BI dashboard was fed live data from one central MS SQL database that had some example data inserted manually into it and was being updated by a Python script. This Python script would get information from Jira issues through Jira's provided API and send the data we needed to MS SQL. The Python script used the requests library to create and send HTTP requests to the Jira API to get the data and Pyodbc to connect with the MS SQL database and insert new rows into it.

Data was also manually inserted into the MS SQL database using sqlcmd to send T-SQL statements to the database.

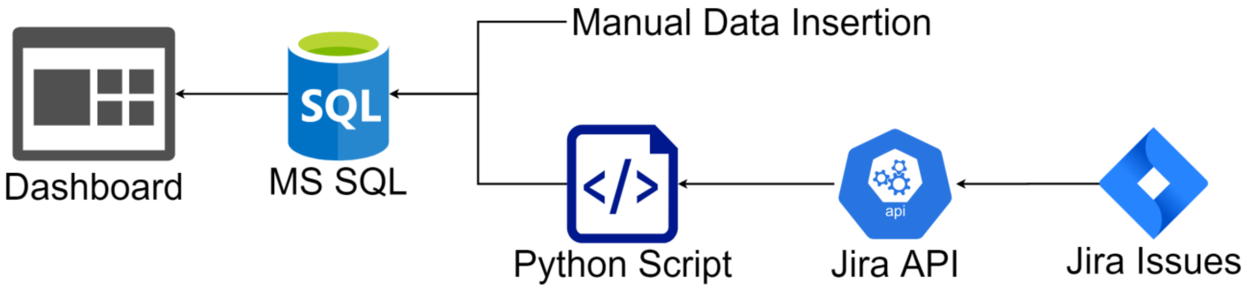


Figure 3: Prototype Architecture Diagram

6.1.3 Context Diagram

The context diagram below in Figure 4, shows how our prototype dashboard and Python script will interact with a selection of outside services and users.

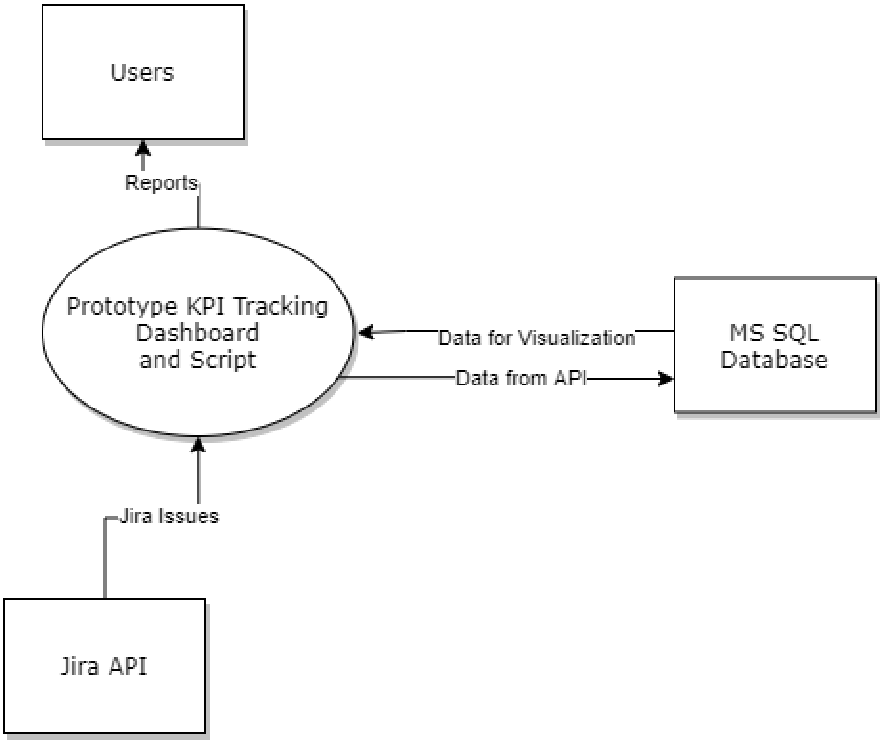


Figure 4: Prototype Context Diagram

6.1.4 Entity-Relationship Models

The entity-relationship model for our prototype as shown in Figure 5, was set up to store the data from Jira issues. We chose to store what we thought were the most important fields from the data, though this may be changed for the final product.

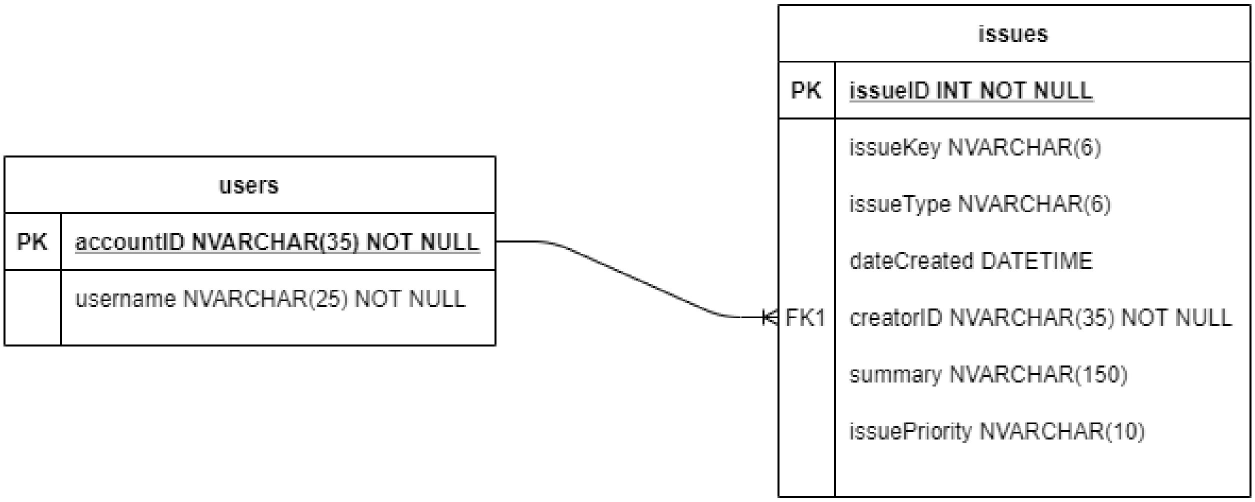


Figure 5: Prototype Database Entity-Relationship Model

6.2 Initial BNP Application

Once we got access to the internal BNP network, we started to create the final piece of software. Shown below is the initial architecture of the software we would create for BNP. This was before any major changes to the project scope or removal of components.

6.2.1 Architecture Diagram

The previously discussed prototype architecture was expanded upon and modified as shown below in Figure 6 as our initial architecture design. While our Power BI dashboard will still be fed live data from one central MS SQL database, that database gets its data from new sources. The issue tracker which is an internal tool BNP has to track client issues will feed data into the MS SQL database now. In addition to just the Jira API as before, the Python script now also pulls data from ServiceNow incidents. It will get this data by querying ServiceNow's provided incident API. The Python script will still insert this retrieved data into the MS SQL database as before.

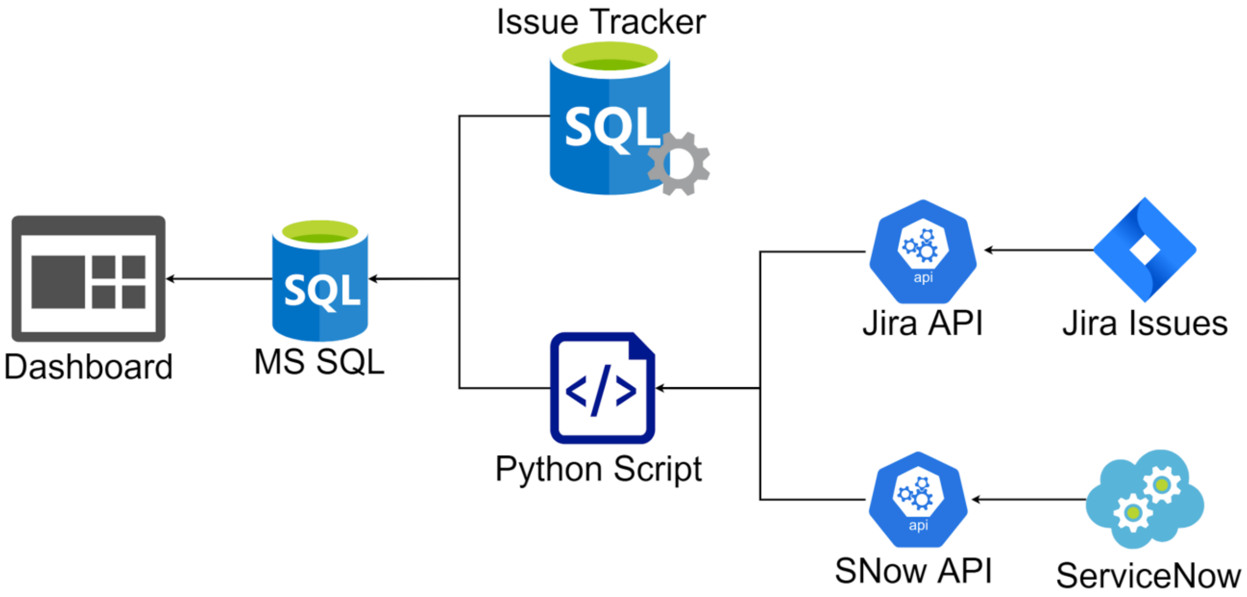


Figure 6: Initial Architecture Diagram

6.2.2 Context Diagram

The context diagram below in Figure 7, shows how we thought our initial dashboard and Python script would interact with outside services and users. This version interacts with many more outside services than our prototype did.

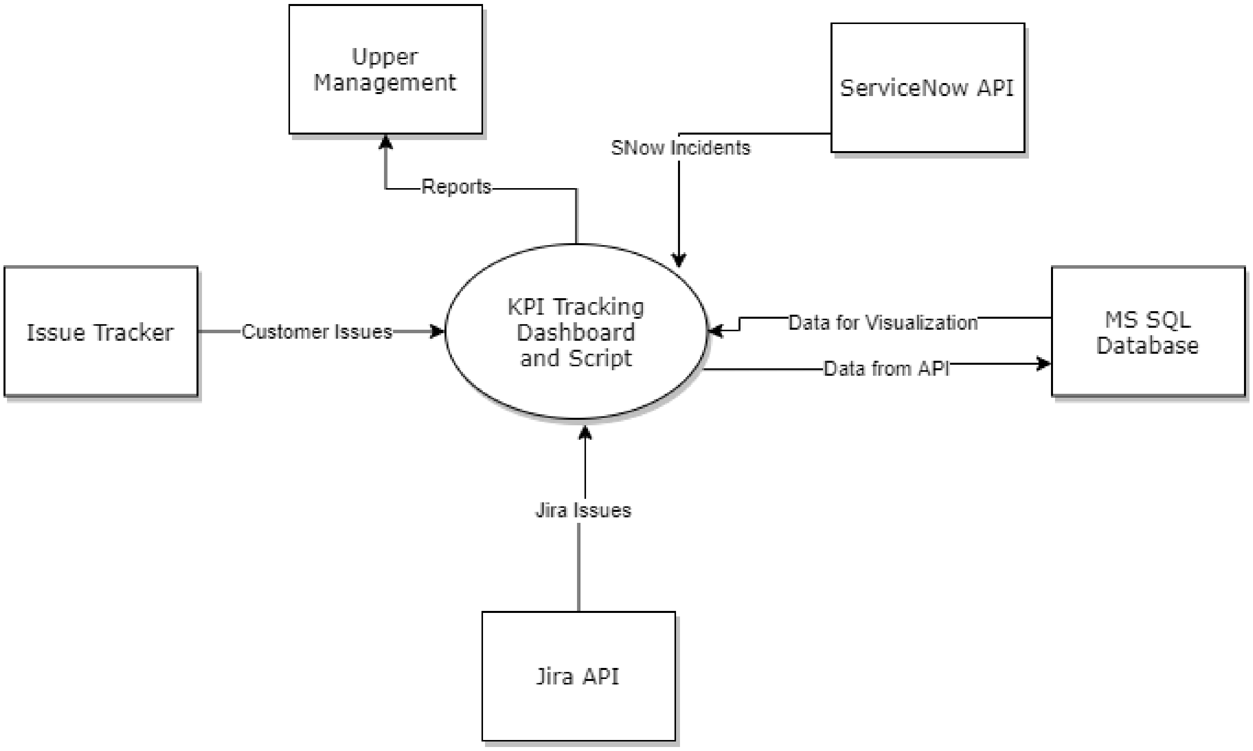


Figure 7: Initial Context Diagram

6.3 Final BNP Application

As the project progressed the scope of the project shrank and certain features either were not necessary anymore or we could not get access to them in time. Shown below is the final version of our software architecture which has changed dramatically from our initial idea. The major changes were the removal of the Power BI dashboard, the removal of the client issue tracker, and the removal of ServiceNow Incidents.

6.3.1 Architecture Diagram

Our initial architecture plans were cut down to what is shown below in Figure 8 for our final product. The main component now is the Python script which will pull Jira issues from the Jira API, clean and validate those issues, and insert them into an MS SQL database.

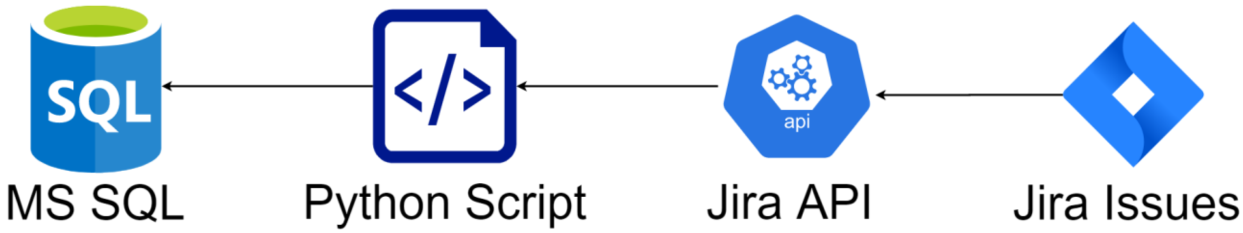


Figure 8: Final Architecture Diagram

6.3.2 Context Diagram

The context diagram below in Figure 9, shows how our final Python script will interact with a small number of outside services and has a simple flow.

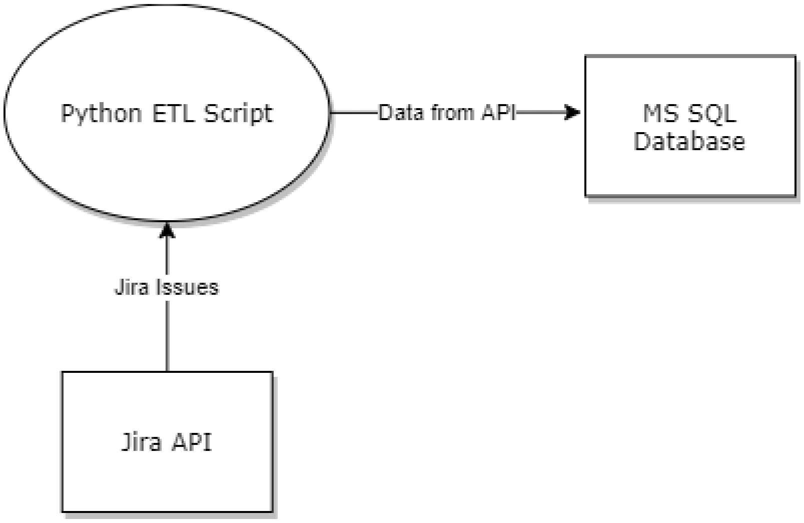


Figure 9: Final Context Diagram

6.3.3 Running the Script

The script is run through the command line and is simply invoked by calling Python on the program. While there are no command-line arguments, there is many configuration settings that will be read from an external configuration file. This will tell the program the information it needs to know about what Jira to access, what MS SQL server to put the cleaned data into, and any other settings the program will need to know. This will also allow for authentication tokens to be securely stored outside of the program.

7. Software Development

7.1 Prototype Agile Sprints

Delays and slowdowns because of Covid-19 led to our group not officially being employed by BNP during our first full week of work on the MQP. Because of this, we had a separate sprint dedicated to creating a prototype application that would hopefully allow us to work more efficiently when we got access to the BNP systems.

For this sprint we had an architectural spike the week before to create our epic and user stories, a sprint planning meeting on Monday morning, daily scrums at 11 AM, and a sprint retrospective and review meeting on Friday.

7.1.1 Sprint 1: October 26 - 30

For our prototype sprint, we decided to keep the number of user stories smaller than normal because the prototype backlog would not be rolled over to the subsequent sprints at all due to our need to focus on the full application once we had the ability to do so. Our sprint backlog is shown below in Table 1.

Table 1: Prototype Sprint 1 Backlog

Epic	User Story	Points	Priority	Risk Status	Risk Mitigation
Prototype Dashboard	As a user, I want to have a similar dashboard experience to the previous dashboard to speed up my workflow	21	Highest	Low	Spend more time learning about Power BI and how it works.
Prototype Dashboard	As a user, I want the dashboard to pull data from an MS SQL server so that it can be continuously updated.	13	High	Low	Make sure the database is properly configured to be read by Power BI.
Prototype	As a user, I	8	Medium	High	Read the Jira

Dashboard	want the dashboard to also be updated with data from Jira, so the dashboard provides more insight to me.				API fully and in-depth

Story Points Completed (Velocity): 42
Hours Worked: 55
Percentage of user story points completed: 76.36%

The team spent a lot of time using the software and tools we had to the fullest to learn all we could about them before the start of our full development. A major blocker did come up during our development of the prototype as the screenshots of the dashboard we were supposed to receive from BNP, which would allow us to develop a similar looking and acting prototype, could not be sent as they contained confidential client information. Because of this, the dashboard we ended up developing contained as many features as we could imagine but it would not allow us to get as much of a head start as we might have hoped.

In our sprint retrospective meeting for the week we were glad that we got the prototype functional and working during the short week, along with the fact that we worked well together even while remote. In terms of what went wrong, the lack of screenshots hindered how useful our prototype could be, though that was not something in our power to change. The week also gave us a good time to learn more about the tools we were using and how they worked along with how best to work remotely. Lastly, we decided that for the next sprint we should try to work more collaboratively instead of separately and then meeting at the end. Overall, it was a successful sprint and we managed to finish every story in the backlog and get off to a good start.

7.2 BNP Agile Sprints

Once we were officially hired and could access the BNP internal network, we started a new set of Agile sprints that would last us for the remainder of the project. Following a similar structure of the previous sprint, we started with an architectural spike to create our epics and user stories. Then during normal weekly sprints we would have a sprint planning meeting on Monday morning to organize ourselves for the week, daily scrums at 11 AM to keep up to date on our progress and blockers, and sprint retrospective and review meetings on Friday afternoons to talk about how the week went and what we managed to get done.

7.2.1 Sprint 0: November 2 - 6

We are calling our first sprint as official employees of BNP Paribas "sprint 0" since the week consisted mostly of the onboarding process and gathering all the software requirements. At the beginning of the week, we met with our point person who introduced us to our direct supervisor, who was now our new point of contact for the project, and another member of BNP who is the tech lead for the KPI project. We also communicated with members from the IT department to assist us in gaining access to all required software and data that we used. During this week we finished completing compliance forms and several training modules that familiarized our team with BNP and what a prime broker is since that is the department we will be working closely with for the duration of our project. In addition, our team focused on working on our paper so we would lessen our workload for when we started working fully with the new software and data after we were to gain access.

For our sprint, we decided to generate generic epics and user stories based on small goals we wanted to accomplish during this week and based upon the current knowledge we had until we acquired full access to BNP's software and data. For this reason, the backlog for this sprint is much smaller than our future sprint backlogs. Our sprint backlog is shown below in Table 2.

Table 2: Backlog for Sprint 0

Epic	User Story	Points	Priority	Risk Status	Risk Mitigation
Project Dashboard	As a developer, I want to get access to BNP's Power BI	2	Highest	High	Reach out to IT department
Jira Integration	As a developer, I want to get access to Jira	2	Highest	High	Reach out to IT department

Client Issue Tracker Integration	As a developer, I want to get access to the Client Issue Tracker	2	Highest	High	Reach out to IT department
ServiceNow Integration	As a developer, I want to get access to ServiceNow	2	Highest	High	Reach out to IT department
MQP Report	As a student, I would like our introduction section to be fully written	5	Medium	Low	Work on it when we have any free time
MQP Report	As a student, I would our background and research to be fully written	5	Medium	Low	Work on it when we have any free time
MQP Report	As a student, I would like our methodology to be fully written	5	Medium	Low	Work on it when we have any free time

MQP Report	As a student, I would like our software development environment to be fully written	5	Medium	Low	Work on it when we have any free time

Key:
Highlighted in red indicates not yet started
Highlighted in yellow indicates in progress
No highlight indicates completed

Story Points Completed (Velocity): 26
Hours Worked: 60
Percentage of user story points completed: 43.33%

Sprint Retrospective Meeting

What Went Well:

- Communication within our team
- Officially became employees at BNP
    - Gained access to most resources

What Went Wrong:

- Onboarding took longer than expected

What We Learned:

- BNP is a large organization
    - Necessary requisites must be met to gain access to internal network and resources

What We Can Improve Upon:

- Meet more often via zoom
- Communicate with BNP more frequently

7.2.2 Sprint 1: November 9 - 13

For this week's sprint, our team worked on gaining access to all of BNP’s software and data sources. The onboarding process took a bit longer than expected and this week consisted mainly of emails and meetings with the BNP KPI project team that we worked with. These meetings were extremely helpful as we learned that our scope had changed and shrunk. Our initial plan for this project was to transfer data visualizations from BNP’s old dashboard on Tableau to a newer data visualization software called Power BI. However, after some internal discussion within the architectural team at BNP, they decided to continue to use their Tableau dashboard.

For our sprint, we generated epics and user stories based on our original goal of creating a Power BI dashboard and transferring visualizations over to the new platform, Power BI. We had to scrap those stories and epics entirely from our backlog. Our sprint backlog was mostly incomplete since we had not been able to access the necessary software and data needed to begin this project. Our sprint backlog is shown below in Table 3.

Table 3: Backlog for Sprint 1

Epic	User Story	Points	Priority	Risk Status	Risk Mitigation
Jira Integration	As a developer, I want to get access to Jira	2	Highest	High	Reach out to IT department
Jira Integration	As a user, I want all data coming from Jira to be cleaned and validated to be usable.	13	High	Medium	Figure out what data is required to be stored in data mart and what format the data needs to be in
Jira Integration	As a developer, I want to be able to fetch data from the Jira API	6	High	High	Read API documentation and figure out

					what data we need
ServiceNow Integration	As a developer, I want to get access to ServiceNow	2	Highest	High	Reach out to IT department
MQP Report	As a student, I would like our abstract to be written.	5	Medium	Low	Work on it when we have any free time
MQP Report	As a student, I would like our software development to be fully written	5	Medium	Low	Work on it when we have any free time
Client Issue Tracker Integration	As a user, I want all relevant data fields to be available to me in the data mart	13	Medium	High	Make sure tables/schema are correctly added in the data mart for inserting data.
Client Issue Tracker Integration	As a developer I would like to get access to the Client Issue Tracker.	2	Highest	High	Reach out to IT department

Client Issue Tracker Integration	As a developer, I want to be able to fetch data from the Client Issue Tracker database	6	High	Medium	Read through API documentation when we receive it
Client Issue Tracker Integration	As a user, I want all data coming from the Client Issue Tracker to be cleaned and transformed correctly to be usable.	6	Medium	Medium	Figure out what data is required to be stored in data mart and what format the data needs to be in

Key:
Highlighted in red indicates not yet started
Highlighted in yellow indicates in progress
No highlight indicates completed

Story Points Completed (Velocity): 7
Hours Worked: 40
Percentage of user story points completed:17.5 %

Sprint Retrospective Meeting

What Went Well:

- Learned what our project entails
  - Can start working right away when we gain full access

What Went Wrong:

- Scope has changed and shrunk
- Getting access is slow

What We Learned:

- Remote access is more difficult at a larger organization when the company has its headquarters located in a different time zone
- Only communicating via emails or scheduled phone calls can be slower than expected

What We Can Improve Upon:

- We must be more aggressive with our emails
- Contact people if we ever have any questions

7.2.3 Sprint 2: November 16 - 20

For this week's sprint, our team spent the first half of the week waiting for access. While waiting for the BNP team to grant us access, we worked on the paper and sent in our report to BNP's IT Security and Cyber Security Surveillance team to be checked. While waiting, we were able to browse on BNP's desktop and get the code repository to clone to our desktop and we created a git project branch. In addition, we spoke to our direct supervisor about who to contact if our group had any additional issues or questions which was the lead for the KPI project.

Toward the end of the week, we were given access to the Linux server. After this, we started to explore the server to familiarize ourselves with it. By doing this, we realized that the Jira server had an unfamiliar authentication than we were used to which was a blocker for us. In addition, our team was successful and made some observation and progress on the following list below:

- Got access to the server and found that we do not have access to the Jira API on the server due to some networking issues
- Able to access the Jira API on our virtual desktops
- Set up our repository on bitbucket
- Copied over our prototype code
- Got access to the development server
- Pair-programmed our Jira API script.

At the end of the week, we set up a meeting with BNP personnel that were a part of our project and spoke about issues we had and what the future for gaining additional software looked like. Overall, we made great progress since we have access to the Linux server and are on track to pick up our work for next week.

For this sprint, we added user stories that we believed could be completed with full access to the sprint backlog. However, access was given later in the week and our progress displays that below in Table 4.

Table 4: Backlog for Sprint 2

Epic	User Story	Risk Category	Points	Priority	Risk Status	Risk Mitigation
Jira Integration	As a user, I want all relevant data fields to be available to me in the data mart	Technical	13	High	Medium	Make sure tables/schema are correctly added in the data mart for inserting data.
Jira Integration	As a user, I want all data coming from Jira to be cleaned and validated to be usable	Technical	6	Medium	Medium	Figure out what format the data needs to be in for the data mart
Jira Integration	As a developer, I want to be able to fetch data from the Jira API	Security Access	6	High	Low	Reach out to IT department
Jira Integration	As a developer, I want data from Jira to automatically propagate from Jira to the data mart	Security Access	13	Medium	Medium	Request permission from IT department

MQP Report	As a student, I would like our software requirements to be fully written	Human	5	Medium	Low	Work on it when we have any free time
MQP Report	As a student, I would like our abstract to be written	Human	5	Medium	Low	Work on it when we have any free time
MQP Report	As a student, I would like BNP to review our paper for compliance issues	Human	8	Highest	Low	Work on it when we have any free time
Client Issue Tracker Integration	As a developer, I would like to get access to the Client Issue Tracker	Internal (BNP)	2	Highest	High	Reach out to direct supervisor/ IT department
ServiceNo w Integration	As a developer, I want to get access to ServiceNow	Internal (BNP)	2	Highest	High	Reach out to direct supervisor/IT department

Key:
Highlighted in red indicates not yet started
Highlighted in yellow indicates in progress
No highlight indicates completed

Story Points Completed (Velocity): 5
Hours Worked: 37.5
Percentage of user story points completed:13.33 %

Sprint Retrospective Meeting

What Went Well:

- Started doing some work
- Able to query Jira data from VDI
- Met with BNP team and discussed how and when we will be reporting to them
    - Daily, end of the workday

What Went Wrong:

- It took nearly a week to get access to the server
- Networking issues between Jira and server

What We Learned:

- We cannot connect to Jira on the server
- Server network is different from the VDI network
- Client issue tracker is on hold
- ServiceNow is in the works but got delayed

What We Can Improve Upon:

- Get access to stuff even earlier somehow
- Daily updates to Team Lead about our progress, risks, and blockers

7.2.4 Sprint 3: November 23 - 27

For this week's sprint, our team was limited with time due to it being a shortened work week due to Thanksgiving. This did not allow our team to achieve all our intended stories since linking the server to Jira took more time than expected and was still being resolved. However, our group was still productive in the condensed week by working with Jira API using a software called cURL that transfers data. We also had Python installed onto our remote desktops which allows us to write our script to query Jira API.

In addition to working on our script, we planned to create an ERD and schema for the data mart so we could store the Jira data. Another item we wanted to accomplish was to finish and test the script which is currently in progress. Lastly, our group wanted to start planning out additional stories for the client issue tracker and ServiceNow, so we communicated with BNP on progress with those applications which was still in the works. A further observation our team made was that remote working slows down the process for obtaining access to necessary software and tools that would allow us to produce work.

For this sprint, we again added user stories that we believed could be completed with full access to the sprint backlog. However, full access was not received yet and the progress we made is displayed below in Table 5.

Table 5: Backlog for Sprint 3

Epic	User Story	Risk Category	Points	Priority	Risk Status	Risk Mitigation
Jira Integration	As a user, I want all relevant data fields to be available to me in the data mart	Technical	13	High	Medium	Take extra time transferring data over correctly formatted with BNP software
Jira Integration	As a user, I want all data coming from Jira to be cleaned and validated to be usable	Technical	6	Medium	Medium	Spend extra time cleaning the data correctly
Jira Integration	As a developer, I want to be able to fetch data from the Jira API	Security Access	6	High	Low	Reach out to IT department
Jira Integration	As a developer, I want data from Jira to automatically propagate from Jira to	Security Access	13	Medium	Medium	Request permission from IT department

	the data mart					
Jira Integration	As a user, I want to know what data we can access from the Jira API	Human	5	Medium	Low	Work on it when we have any free time
MQP Report	As a student, I would like our abstract to be written	Human	5	Medium	Low	Work on it when we have any free time
MQP Report	As a student, I would like BNP to review our paper for compliance issues	Human	8	Highest	Low	Work on it when we have any free time
Client Issue Tracker Integration	As a developer, I would like to get access to the Client Issue Tracker	Internal (BNP)	2	Highest	High	Reach out direct supervisor/ IT department
ServiceNo w Integration	As a developer, I want to get access to	Internal (BNP)	2	Highest	High	Reach out to direct supervisor/

	ServiceNow					IT department

Key:
Highlighted in red indicates not yet started
Highlighted in yellow indicates in progress
No highlight indicates completed

Story Points Completed (Velocity): 10
Hours Worked: 56
Percentage of user story points completed:17.86 %

Sprint Retrospective:

What Went Well:

- Worked on getting access
- Queried Jira at least once

What Went Wrong:

- Still waiting for access to Jira on the server
  - Is in progress

What We Learned:

- Server is on a different network

What We Can Improve Upon:

- Meet more frequently
  - As a team
  - With BNP team
  - With advisors

7.2.5 Sprint 4: November 28 - December 1

For this week's sprint, we completed all the stories that were attainable that we had from last week's sprint and from our backlog. These stories were mostly on finishing our final paper. To start the week, we communicated back with our KPI lead with a complete inventory of fields we are able to pull from the Jira API for Jira issues. That same day we also received our first draft of our paper back from BNP's IT Security and Cyber Security Surveillance to ensure it was safe to share with others outside of the BNP company like our professors. Later on, in the week, our team successfully wrote our script, plugged it into python, and ran it successfully on our remote desktops. Now we are just waiting for the server to be able to access Jira.

At the end of week, we created an ERD and schema for the data mart to eventually store the Jira data in. Unfortunately, our group came to the decision to remove our additional stories regarding the client issue tracker as we are short on time and have not received access to that application. On the last day of our sprint, we finally received access to ServiceNow, but we did not have enough time to start full development for it.

For our last sprint, we added all user stories that were located in our backlog to the sprint backlog and completed all the ones that we could. Listed below in Table 6 are the stories that sprint 4 entailed.

Table 6: Backlog for Sprint 4

Epic	User Story	Risk Category	Points	Priority	Risk Status	Risk Mitigation
Jira Integration	As a user, I want all relevant data fields to be available to me in the data mart	Technical	13	High	Medium	Take extra time transferring data over correctly formatted with BNP software
Jira Integration	As a user, I want all data coming from Jira to be cleaned	Technical	6	Medium	Medium	Spend extra time cleaning the data correctly

	and validated to be usable					
Jira Integration	As a developer, I want to be able to fetch data from the Jira API	Security Access	6	High	Low	Reach out to IT department
Jira Integration	As a developer, I want data from Jira to automatically propagate from Jira to the data mart	Security Access	13	Medium	Medium	Request permission from IT department
MQP Report	As a student, I would like BNP to review our	Human	8	Highest	Low	Work on it when we have any free time

	paper for compliance issues					
MQP Report	As a student, I would like our executive summary to be written	Human	5	Medium	Low	Work on it when we have any free time
MQP Report	As a student, I would like our software design to be fully written	Human	5	Medium	Low	Work on it when we have any free time
MQP Report	As a student, I would like our assessment to be written	Human	5	Medium	Low	Work on it when we have any free time

MQP Report	As a student, I would like our future work to be written	Human	5	Medium	Low	Work on it when we have any free time
MQP Report	As a student, I would like our conclusions to be written	Human	5	Medium	Low	Work on it when we have any free time
MQP Report	As a student, I would like our paper to be correctly formatted	Human	10	Medium	Low	Work on it when we have any free time
MQP Report	As a student, I would like our paper to	Human	12	Medium	Low	Work on it when we have any free time

	be fully edited and revised					
MQP Report	As a student, I would like BNP to review our paper for compliance issues	Human	8	Medium	Low	Work on it when we have any free time
Client Issue Tracker Integration	As a developer, I would like to get access to the Client Issue Tracker	Internal (BNP)	2	Highest	High	Reach out direct supervisor / IT department
ServiceNow Integration	As a developer, I want to get	Internal (BNP)	2	Highest	High	Reach out to direct supervisor /IT

	access to Service Now						department

Key:
Highlighted in red indicates not yet started
Highlighted in yellow indicates in progress
No highlight indicates completed

Story Points Completed (Velocity): 105
Hours Worked: 120
Percentage of user story points completed: 98.1 %

Sprint Retrospective:

What Went Well:

- Got the paper back from compliance and edits from our advisors
- Finished writing the paper

What Went Wrong:

- Time crunch. Not enough time to finish everything we needed to as soon as we should have.

What We Learned:

- Email early and often
- Do things proactively not retroactively

What We Can Improve upon:

- Send daily email reminders if we need something

8. Assessment

8.1 Achievements

Throughout our 7-week term, we had many achievements as a team while facing many challenges. We were able to successfully implement a functional prototype of what we thought our project was going to be like before we started at BNP. This was critical for us to gain experience as the prototype ended up being very similar to our actual project.

With the limited time we were able to work on our project and the access restraints we faced, we were able to implement most of the core project requirements. We implemented a Python script that can query the Jira API and load data into a data mart. The project we started can easily be expanded to include ServiceNow and the client issue tracker.

8.2 Major Takeaways

8.2.1 Opportunity

Throughout the project, there were many opportunities for both BNP and our team. BNP had the opportunity to take the next step to better fulfill the needs of their clients, track down issues, and have them resolved at a quicker rate. This will allow them to maintain their success with customers and to gain recognition as a top prime broker. For our project team, we were given the opportunity to work on expanding a tool used by BNP which would allow us to gain experience with working in a major company and producing useful tools.

8.2.2 Potential

The project has many potential benefits moving forward. The major potential benefit for BNP is the ability to better track their clients' complaints regarding their SLAs using the additional data that Jira provides. This will allow for quicker fixes to their agreement on their given platform and will keep these customers satisfied. More information will be provided to top level executives to get a better picture of what is going on with their SLAs and what BNP is doing to fix breaches. Moving forward, the architecture team at BNP could migrate their visualization for upper management from Tableau to Power BI.

8.2.3 Learning Experience

During our project, we as a group have learned numerous things. The most important takeaway we learned was that in a large organization, there are a multitude of prerequisites that must be taken care of before an employee can officially start to work and gain access to an organization's resources. This can take a while to complete, and because of the COVID-19 crisis, this made it take much longer than usual since everybody is working remotely and is thrown off from their normal day-to-day routine.

8.2.4 What could be done Differently

The process of receiving our remote access, including things like our key cards, downloaded applications, and permissions for access to software on our remote desktop could have been handled better. However, this was not possible since at BNP and other large banks, one must be an employee registered in their system to receive these things. In the future, for either project teams like ours or interns, BNP could already have these pre-approved for these types of "temporary" employees so they can start making valuable contributions right away.

8.2.5 Remote Efficiency during COVID-19

With all these different avenues of opportunities to be efficient with our time, we still had a hard time scheduling meetings and gaining access as the team we worked with at BNP are busy people. However, when we did gain traction and began making progress on the project, we made valuable contributions and started to delve deeper into their Jira and KPIs and began linking it to the rest of the data.

In addition, our project scope was constantly changing as we worked due to internal decisions that were made by the architecture team and other BNP teams. This caused us to have to adapt and adjust our work schedule along with our sprints. This experience was a good learning point for our team since unexpected situations like this occur frequently in the workforce. However, if this were in person, things would be different by communicating directly with the different teams at BNP in the office.

The benefit to working virtually was that we were able to communicate with various sorts of BNP personnel any distance away. This was helpful since most of the people whom we or the KPI project team were in contact with were located in a different country or time zone. Also, if we needed to get in touch and schedule a time to meet, we could easily look up and see their availability through their email system which told us if they were available, busy, or offline.

8.3 Business Learning

8.3.1 Leadership

From a business perspective, there were many business learning points that we saw while working with BNP. From a leadership standpoint, we saw that our original supervisors were primarily our first source of contact. Their role was to introduce us to our main sources of contact, the KPI project team and the lead on it who became our new direct supervisor for the duration of the project. The only downside from this experience was that even with defined leaders, they did not have the power to directly grant us access to software and applications that were needed for the project.

8.3.2 Scope Management

Coming into this project, our scope started out very large since it consisted of creating a dashboard on Power BI to view how their platform is performing based on KPIs and integrating the Client Issue Tracker, Jira, and ServiceNow into their current database. Once we began, the architecture team made the decision to get rid of working with Power BI and the lack of time and access did not allow us to work with the Client Issue Tracker or ServiceNow until too late. This was yet another example of a real work environment and how scope can change.

8.3.3 Our Team's Takeaways

Over the seven-week course of working at BNP, we gained an in-depth understanding of BNP and how a large organization runs, along with the processes their employees must go through. The first thing we learned was that in order to get access, they must go through a variety of teams whether it be located in the same office building or in another country to gain access to software, tools, and data. This process reiterated to us that security is a top priority for the company. Secondly, we learned it is better to be proactive than retroactive as everyone tends to be busy with work. Asking questions and for help early in the process help get things moving quicker and with a better understanding among everyone. If we could go back to the start of this project after this experience, we would be more proactive about asking questions and communication. At WPI, we are used to our professors being readily available throughout the week and even sometimes on the weekend. This was the most difficult aspect to adjust to for our group especially being remote.

8.4 Challenges

Many challenges occurred throughout the project that had to be worked around. The major challenge that plagued us throughout the project was getting access to different tools, software, and systems. BNP is a very large company so access to nearly everything is only given to individuals who need it. While this is a smart thing to do, it did not go well with the accelerated 7-week schedule we had to work with from WPI. With everything being remote, gaining access to the software and servers we needed ended up taking a significant amount of time that blocked us. This loss of time to work on the project led to a significant drop in work we could produce.

The other major challenge we faced was working remotely due to Covid-19. Initially we did not think of this as a potential problem as we could still access the BNP network remotely and communicate among our group efficiently. As the project progressed though it became apparent that most things just took longer while remote. Communication among our group and with our sponsors was slower than we anticipated as just a simple question could take a few minutes to get a response from another group member. As most of us were used to working completely in-person, this change was a lot more challenging to adapt to. We did manage to work through this as we understood the problem better. We had more video meetings together along with sending messages more frequently and earlier.

8.4.1 Integration Challenges

There were also many challenges that came from the attempted integration of our scripts into the BNP ecosystem. To properly write and deploy our script we needed access to both Jira and the server that would run our code. Gaining access to both resources took a long amount of time due to complications and slowdowns from remote interaction. Once we did finally gain access to these resources, there were still problems with accessing Jira from the server. Because of the network configuration, we had to do more work to have the server be able to communicate with the Jira API. This again led to more slowdowns in the integration of our scripts. After working through these challenges, we were able to successfully integrate our scripts.

9. Future Work

9.1 ServiceNow and Client Issue Tracker Integration

For our project, we were initially supposed to integrate three services into the data mart: Jira, ServiceNow, and a Client Issue Tracker. We were unable to get access to the ServiceNow API until the last week of the project term and the Client Issue Tracker integration was delayed internally. If this project were to be continued, the ServiceNow and Client Issue Trackers could be easily added to our project by following the same procedure we used for Jira. This entails adding API access to the ETL Python script we developed and adding a schema for the data to the data mart.

The integration of ServiceNow and the Client Issues Tracker will provide the Prime Brokerage team with key data that will help them to better analyze their platform. With the infrastructure we developed adding additional services will be easy if there are no access issues on the server.

9.2 Power BI Dashboard

Unfortunately, we did not have the time to work on creating the Power BI dashboard, and because of this there is a lot of future work to be done in this area. BNP did decide that they would like to remain with Tableau for the time being but were open to a prototype being created with Power BI to see what could be accomplished. The two major tasks to be done are the conversion of the current Tableau dashboard to Power BI and the expansion of information presented by the dashboard. While Tableau and Power BI are similar software there are some differences in how they work, and it would require effort to recreate what BNP currently has within Power BI. The second part of the process would be taking that newly recreated dashboard and expanding it with the new information present in the data mart and the new functionalities that Power BI provides to create a more informative dashboard. Ideally, this new dashboard would be as easy to use and understand as the previous one while also providing more information and insights. While creating new, useful, and understandable features is not an easy task it would be the best way to show that the prototype dashboard would be worth the effort to switch too.

10. Conclusion

BNP is always striving to improve their prime brokerage business in competition with the rest of the market. With the rise of the multi-prime operating environment, many hedge funds are ready to swap brokers if their quality of service drops too much. To make sure BNP is providing the service hedge funds and other investors need they must make sure to maintain their SLA conditions. In such a large company that feat can be daunting and hard to manage. Using informative KPIs, BNP has been able to manage all this information and keep their clients' needs fulfilled. To expand these KPIs to track an even larger array of issues, BNP realized the need to pull in data from new sources to power their KPIs and insights.

To this end, our team worked on adding in new data sources to the KPI process. The major new data source our team worked to implement was Jira issues. We created a Python script that would query the Jira issues API to retrieve all the new data. It would then clean and validate this data to ensure the usefulness of it and that it would fit into the designated schema. Finally, the script would insert the data into the data mart to be used to feed the KPI dashboard and help inform decisions. While we were not able to get access in time, we were also planning to repeat this process with ServiceNow and their internal client issue tracker to add in more data for even greater insights. This new data source would allow BNP to manage their prime brokerage business even better and allow them to continue keeping their client's needs fulfilled.

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