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“PowerBi report automation”

Utilising PowerShell to automate reporting in PowerBI

Contents

[2 Table of Figures 4](#_Toc130234343)

[3 Summary 7](#_Toc130234344)

[4 Introduction 8](#_Toc130234345)

[4.1 Project Type 8](#_Toc130234346)

[4.2 The organisation 8](#_Toc130234347)

[4.3 System Background and Project Scope 8](#_Toc130234348)

[4.4 Fieldview 9](#_Toc130234349)

[4.5 Smartsheet 10](#_Toc130234350)

[4.6 Sharepoint/Office365 10](#_Toc130234351)

[4.7 Situation at the time of the project 10](#_Toc130234352)

[4.8 What were the problems. 11](#_Toc130234353)

[5 Use Case 11](#_Toc130234354)

[6 Technologies, Tools, and Languages 11](#_Toc130234355)

[6.1 Potential Issues 12](#_Toc130234356)

[7 Objectives 12](#_Toc130234357)

[8 Methodology 12](#_Toc130234358)

[8.1 Dataflow 12](#_Toc130234359)

[8.2 Modelling 13](#_Toc130234360)

[8.3 Feedback Loop 13](#_Toc130234361)

[8.4 Technologies 14](#_Toc130234362)

[8.4.1 PowerBI 14](#_Toc130234363)

[8.4.2 SOAP API 14](#_Toc130234364)

[8.4.3 PowerShell 14](#_Toc130234365)

[8.4.4 Power Automate 15](#_Toc130234366)

[8.4.5 DAX 15](#_Toc130234367)

[9 Project Plan 16](#_Toc130234368)

[10 Project Planner 16](#_Toc130234369)

[11 Implementation 17](#_Toc130234370)

[11.1 Phase 1: Research & Training 17](#_Toc130234371)

[11.2 Phase 2: Smartsheet Data Connector setup 20](#_Toc130234372)

[11.3 Phase 3: FV API setup and Data Persistence 21](#_Toc130234373)

[11.3.1 Data persistence 23](#_Toc130234374)

[11.4 Phase 4: PowerBI Dashboard – Fieldview Vehicle-check 24](#_Toc130234375)

[11.5 Phase 6: PowerBI Dashboard – SmartSheet Timesheet 31](#_Toc130234376)

[11.6 Phase 7: PowerBI Dashboard – Fieldview Timesheet 32](#_Toc130234377)

[11.7 Phase 8: PowerBI Dashboard – Asset Manager 36](#_Toc130234378)

[11.8 Phase 9: Automation of Data flows and Power BI Refresh 39](#_Toc130234379)

[11.8.1 Task Scheduler - Webserver 39](#_Toc130234380)

[11.8.2 Power Automate – Domain Controller Server 40](#_Toc130234381)

[11.8.3 Power Automate – Domain Server - Reverting to Task Scheduler 45](#_Toc130234382)

[11.8.4 PowerBI – Automated Refresh and Publish 50](#_Toc130234383)

[12 Project Evaluation 54](#_Toc130234384)

[12.1 Achievements 54](#_Toc130234385)

[12.2 Knowledge attained. 55](#_Toc130234386)

[12.3 Future Learning 55](#_Toc130234387)

[12.4 Future Development Work 55](#_Toc130234388)

[12.4.1 Review of the current state 55](#_Toc130234389)

[12.4.2 Adding more data sources 56](#_Toc130234390)

[12.4.3 Long Term future functionality 58](#_Toc130234391)

[12.5 Conclusion 58](#_Toc130234392)

[13 References 59](#_Toc130234393)

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Student…………………………………............................... Date ….…………….............

Workplace Mentor………………………………………… Date ……………………………

# Table of Figures

[Figure 1: Overview of existing potential systems available to the project 8](#_Toc130234482)

[Figure 2: Sample view of Fieldview mobile form 9](#_Toc130234483)

[Figure 3:Sample view of the Fieldview widget reports 9](#_Toc130234484)

[Figure 4: Sample view of Smartsheet form 10](#_Toc130234485)

[Figure 5: The Flow of Data from Fieldview to PowerBI 13](#_Toc130234486)

[Figure 6: Sample Representation of the data model in PowerBI 13](#_Toc130234487)

[Figure 7:Sample View of DAX language in the formula bar of Power BI 15](#_Toc130234488)

[Figure 8: Microsoft Planner – Chart of Buckets 16](#_Toc130234489)

[Figure 9:Microsoft Planner - Status of tasks and Buckets 17](#_Toc130234490)

[Figure 10:Sample of input Parameters 18](#_Toc130234491)

[Figure 11: SOAP request and response 18](#_Toc130234492)

[Figure 12:Returned information. 18](#_Toc130234493)

[Figure 13:Call quota per API token 19](#_Toc130234494)

[Figure 14: Certificate of Completion 20](#_Toc130234495)

[Figure 15: Get Data view in PowerBI of Online Services 20](#_Toc130234496)

[Figure 16:Preview of Connected Table ready to be loaded into PowerBI. 21](#_Toc130234497)

[Figure 17: View of Created API Tokens in Fieldview 21](#_Toc130234498)

[Figure 18: Code Snippet of the New-WebServiceProxy used to pull data from Fieldview. 22](#_Toc130234499)

[Figure 19:Code snippet of foreach loop with an if else statement 22](#_Toc130234500)

[Figure 20:Screenshot of Sample Data from the GetProjectFormsList( ) call. 23](#_Toc130234501)

[Figure 21:Sample Code of writing a file to Sharepoint Online 24](#_Toc130234502)

[Figure 22:Screenshot of successfully writing the data to Sharepoint Online in PowerShell 24](#_Toc130234503)

[Figure 23: Code of File export Sample 25](#_Toc130234504)

[Figure 24: Export to SharePoint with automated details 25](#_Toc130234505)

[Figure 25: Form data as exported from FV. 26](#_Toc130234506)

[Figure 26: DAX code of Count 26](#_Toc130234507)

[Figure 27: View of Counts 26](https://typetecmg-my.sharepoint.com/personal/aingelsten_mainline_ie/Documents/HDIP%20POWERBI%20Project%202023/HDIP-POWERBI-Project/KPI%20with%20PowerBI.docx#_Toc130234508)

[Figure 28: View of Embed Link 27](https://typetecmg-my.sharepoint.com/personal/aingelsten_mainline_ie/Documents/HDIP%20POWERBI%20Project%202023/HDIP-POWERBI-Project/KPI%20with%20PowerBI.docx#_Toc130234509)

[Figure 29:View of admin message 27](https://typetecmg-my.sharepoint.com/personal/aingelsten_mainline_ie/Documents/HDIP%20POWERBI%20Project%202023/HDIP-POWERBI-Project/KPI%20with%20PowerBI.docx#_Toc130234510)

[Figure 30: View of embed code view. 27](https://typetecmg-my.sharepoint.com/personal/aingelsten_mainline_ie/Documents/HDIP%20POWERBI%20Project%202023/HDIP-POWERBI-Project/KPI%20with%20PowerBI.docx#_Toc130234511)

[Figure 31: View of Sharepoint Online Embed function. 28](https://typetecmg-my.sharepoint.com/personal/aingelsten_mainline_ie/Documents/HDIP%20POWERBI%20Project%202023/HDIP-POWERBI-Project/KPI%20with%20PowerBI.docx#_Toc130234512)

[Figure 32: View of Sharepoint Intranet 28](https://typetecmg-my.sharepoint.com/personal/aingelsten_mainline_ie/Documents/HDIP%20POWERBI%20Project%202023/HDIP-POWERBI-Project/KPI%20with%20PowerBI.docx#_Toc130234513)

[Figure 33: Code snippet of Pipedrive script 29](https://typetecmg-my.sharepoint.com/personal/aingelsten_mainline_ie/Documents/HDIP%20POWERBI%20Project%202023/HDIP-POWERBI-Project/KPI%20with%20PowerBI.docx#_Toc130234514)

[Figure 34: View of table relationships 30](https://typetecmg-my.sharepoint.com/personal/aingelsten_mainline_ie/Documents/HDIP%20POWERBI%20Project%202023/HDIP-POWERBI-Project/KPI%20with%20PowerBI.docx#_Toc130234515)

[Figure 35: View of Values per Quarter 30](https://typetecmg-my.sharepoint.com/personal/aingelsten_mainline_ie/Documents/HDIP%20POWERBI%20Project%202023/HDIP-POWERBI-Project/KPI%20with%20PowerBI.docx#_Toc130234516)

[Figure 36: Report view of logged activities 31](https://typetecmg-my.sharepoint.com/personal/aingelsten_mainline_ie/Documents/HDIP%20POWERBI%20Project%202023/HDIP-POWERBI-Project/KPI%20with%20PowerBI.docx#_Toc130234517)

[Figure 37: View of Smartsheet timesheet table 31](#_Toc130234518)

[Figure 38: View published on Company Intranet 31](#_Toc130234519)

[Figure 39: Drill down view Timesheet 32](#_Toc130234520)

[Figure 40: Code Snippet of 4 answer queries 32](#_Toc130234521)

[Figure 41: Code snippet of API call 33](#_Toc130234522)

[Figure 42: Code snippet of export to SharePoint 33](https://typetecmg-my.sharepoint.com/personal/aingelsten_mainline_ie/Documents/HDIP%20POWERBI%20Project%202023/HDIP-POWERBI-Project/KPI%20with%20PowerBI.docx#_Toc130234523)

[Figure 43: Query view in PowerBI 34](#_Toc130234524)

[Figure 44: Table relationships in PowerBI 34](#_Toc130234525)

[Figure 45: Summary visualisation of the hours per contract and user 35](#_Toc130234526)

[Figure 46: Drill down view per contract, month, and person. 35](#_Toc130234527)

[Figure 47: View of Devart Configuration 36](#_Toc130234528)

[Figure 48:View of connected Data Source 37](#_Toc130234529)

[Figure 49: View of Tables available from Asset Manager. 37](#_Toc130234530)

[Figure 50: Query of the latest service ID 38](#_Toc130234531)

[Figure 51:Table query of the latest service ID 38](#_Toc130234532)

[Figure 52:View of the joined table relationship. 38](#_Toc130234533)

[Figure 53:View of asset types and corresponding table. 38](#_Toc130234534)

[Figure 54: Code snippet of copy code 39](#_Toc130234535)

[Figure 55: View of Task Scheduler setup to run script every 15 min. 39](#_Toc130234536)

[Figure 56: View of Scheduled copy task in situ with running history 40](#_Toc130234537)

[Figure 57: Installation of Power Automate desktop on domain controller server. 41](#_Toc130234538)

[Figure 58: Before implementation of flows 41](#_Toc130234539)

[Figure 59: Creating the Run PowerShell Script on Power Automate Desktop 42](#_Toc130234540)

[Figure 60: Adding the script to run in the Flow. 42](#_Toc130234541)

[Figure 61: View of all the 5 PowerShell scripts that was setup on the Power Automate desktop. 43](#_Toc130234542)

[Figure 62: Recurrence step on the Power Automate Cloud 43](#_Toc130234543)

[Figure 63: Running the Power Automate desktop flow on the Power Automate Cloud 44](#_Toc130234544)

[Figure 64: Connection used for cloud hosted servers to run the PowerShell scripts. 44](#_Toc130234545)

[Figure 65: Sample of a flow -this running multiple scripts 44](#_Toc130234546)

[Figure 66:Summary view of the cloud flows 45](#_Toc130234547)

[Figure 67: Initial setup with run history 46](#_Toc130234548)

[Figure 68: Successful runs of flows 46](#_Toc130234549)

[Figure 69: View of several failed flows 47](#_Toc130234550)

[Figure 70: Detailed view of a failed flow 47](#_Toc130234551)

[Figure 71: Detailed flow error message 47](#_Toc130234552)

[Figure 72: Turning off all the Cloud Flows 48](#_Toc130234553)

[Figure 73: Setting up the Task Scheduler 48](#_Toc130234554)

[Figure 74: Sample view of the export/import XML file of a task 49](#_Toc130234555)

[Figure 75: Summary view of the 5 PowerShell scripts in the Task Scheduler 49](#_Toc130234556)

[Figure 76: PowerBI Datasets view for automated updates. 50](#_Toc130234557)

[Figure 77:On-Premises data gateway 51](#_Toc130234558)

[Figure 78: Gateway connected. 51](#_Toc130234559)

[Figure 79:Authentication of data sources 52](#_Toc130234560)

[Figure 80: Scheduled refresh view 52](#_Toc130234561)

[Figure 81: Refresh History 53](#_Toc130234562)

[Figure 82:PowerBI refresh error. 53](#_Toc130234563)

[Figure 83: SonicWALL Netextender. 54](#_Toc130234564)

[Figure 85: Change of Task Scheduler 56](#_Toc130234565)

[Figure 86: DAX formula to resolve weighted monthly value. 56](#_Toc130234566)

[Figure 87:PowerBI view of weighted monthly value 56](#_Toc130234567)

[Figure 88: Sample of requested view 1 57](#_Toc130234568)

[Figure 89: Sample of requested view 2 58](#_Toc130234569)

# Summary

This project automates the generation and visualization of a company’s KPI reports.

Data is pulled from local hosted as well as remote cloud-based systems, for example Fieldview and PipeDrive, via their APIs and the data is stored into SharePoint Online as CSV Data. PowerBI in conjunction with the formula language DAX is utilised as the visualisation tool, to display the stored data, as up to date organisational interactive KPI reporting diagrams on the company’s intranet.

PowerShell is used as the scripting language to facilitate the data pull and. The data pull and PowerBI refresh is scheduled several times per day, so employees have access to near live data.

# Introduction

## Project Type

This is a work-based project, where I improved the reporting process within several business areas. I learned new skills in relation to developing a KPI dashboard using the knowledge acquired from the course modules. The internal company mentor was the company’s Chief Financial Officer. This meant that I was able to spend time on this project as part of my day-to-day work.

## The organisation

Company A is an engineering solutions provider operating in Ireland, the UK and Scandinavia. It provides a wide range of services from the Design & Build of Sub-stations to construction of Airside Aviation Infrastructure to Turn-key Wind & Solar Energy Solutions. The company has a turnover of approx. 30million euro and employees approximately one hundred staff.

## System Background and Project Scope

Company A has several systems that hold business information. Finance, Health and Safety and Operations staff query this data on a regular basis to produce business performance reports and to generate KPI (Key Performance Indicators) metrics for the different departments. The reports are generated on a weekly or monthly basis but there are also ad hoc reports.



Figure 1: Overview of existing potential systems available to the project

The current systems identified for the initial project scope are:

|  |  |  |
| --- | --- | --- |
| **System** | **Function** | **Location** |
| **Fieldview** | Record QA/QC/Admin forms and Timesheet for site staff | Cloud |
| **Smartsheet** | Record timesheets for Salaried Staff | Cloud |
| **Office365** | SharePoint, Excel, word etc | MS Cloud |

## Fieldview

Fieldview is a third-party cloud-based and off-line mobile solution developed by Trimble (Floor et al., n.d.). It is used in Company A to replace paperwork on site. Users are equipped with a mobile device (phone and tablet), where the app has been installed. The users log in and use the application for snagging tasks, forms & permits, project delivery and handover. When the mobile device is synced – data is pushed to the cloud hosted database.

Graphical user interface, text, application

Description automatically generated

Figure 2: Sample view of Fieldview mobile form

Chart

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Figure 3:Sample view of the Fieldview widget reports

## Smartsheet

Smartsheet is an online hosted solution that allows organisations to plan, track, automate, and report on work (Smartsheet, 2019). Company A uses the online application to track timesheets for salaried staff.

Graphical user interface

Description automatically generated

Figure 4: Sample view of Smartsheet form

## Sharepoint/Office365

During the spring of 2022, the organisation fully migrated its whole IT environment to the Sharepoint Online cloud, i.e., the full file repository of the organisation approx. 2.5 TB of files is hosted online with 24/7 365 access.

SharePoint Online is a cloud-based SAAS - “software as a service” provided by Microsoft, where organisations and users store and share information and use it collaboratively (Www.microsoft.com, n.d.). All data and software are hosted on Microsoft own servers. Access, storage, and use of software is done by using a subscription model.

## Situation at the time of the project

The company had, over the summer of 2022, revised the KPI process and in September rolled out a new KPI process where departmental stakeholders fill in excel spreadsheet reports with various KPI data. For example, the number of hours spent by employee per contract and other data like work site accident frequency etc. The departmental stakeholders access several systems and pull-down pdf and excel reports, from where they extract data and then collate it into excel spreadsheets which is then presented to the leadership team. This process is repeated monthly.

The company was aware that this was a time-consuming process and when it’s well established, the company was looking to improve the efficiencies in this process. The company had already identified that business intelligence tools like Power BI could be used to display almost real-time dashboard views of the business data. During 2022 there was internal talks about identifying and bringing in business intelligence consultants/developers to do this work during 2023. Within the project, I investigated business intelligence products for example the Microsoft Power BI platform. It’s worth noting that the company had fully migrated to Office365/SharePoint during 2022 and was using the SharePoint platform as Intranet and repository for company data.

## What were the problems.

The two main problems were:

1. Manual input of data by staff into excel spreadsheets is time consuming and this time can be better spent on other business processes and tasks.
2. The time difference between the live situation and the compiled report by staff, lead to delays in business understanding, for example if work is profitable or not.

The CFO of Company A was therefore looking for a solution that could display KPI information from systems on the internal company SharePoint internet website.

# Use Case

The primary reason for developing a dashboard pulling data from sources is the time saving. For example, the Fieldview application is structed in such a way, that when a user would like to do a count of reports done in a week, he will have to log in, navigate to the report view, enter a date range, then export to excel, and in excel then analyse the data.

A simple calculation shows how a dashboard can provide efficiencies.

Example, a user spends 1.5 hour every week to access Fieldview and compile a report of the amount of vehicle reports submitted by staff that week. 1.5 hours x 48 working weeks = 72 Hours which equates to 9 working days per year.

# Technologies, Tools, and Languages

As this was a work-based project the preferred direction from the company supervisor was to use known technologies that the company had access to or was already using. The two main reasons for this were that it creates greater resilience, and any costs are known, for example Company A host a Windows 2019 server in the Azure cloud. List of potential technologies, tools, and languages:

* Office365
* SharePoint
* Power BI Desktop
* Power BI Data Gateway
* Power Query Editor
* SOAP UI
* MS Planner
* Html
* PowerShell
* Sharepoint Online Management Shell
* M language and DAX

## Potential Issues

As the project had access to commercially sensitive and potentially personal data, measures were put in place to minimise exposure of this data. This limited the scope of which systems and data that was incorporated into the project. If it was not feasible to limit the exposure, data was redacted from screenshot of views.

# Objectives

This project had three main objectives:

* **Ease of access.** By connecting separate data sets, transforming, and cleaning the data into a data model and creating charts or graphs to provide visuals of the data; it will assist users to find insights, within the organisation, of the operational data generated in Fieldview.
* **Real-time information.** To give users in the organisation, an updated almost real-time view of the situation in the company. This should provide the ability to solve problems and identify issues and opportunities.
* **Process improvement.** By streamlining publication and the distribution of the data into dashboards – users interpret published data whenever the underlying dataset is updated. This is instead of compiling reports through a time-consuming process and sharing the data in emails or a shared drive for stakeholders to then review.

# Methodology

## Dataflow

The data was envisaged to flow in the following way.

1. Users generate data onsite in the Fieldview app.
2. By syncing the device – the data generated in the app is pushed to the Fieldview server environment (Cloud)
3. The PowerShell scripts will then run automated on a server hosted in the Company A’s Azure environment, pull data from the Fieldview cloud.
4. Data is then saved in CSV files by the PowerShell scripts to Sharepoint Online.
5. PowerBI is then connected to the CSV files and refreshed on a regular basis.



Figure 5: The Flow of Data from Fieldview to PowerBI

## Modelling

Below is a simple representation of modelling of the data in Power BI, it was envisaged that data was presented in several tables. These tables are then joined pending any queries that they may relate to. These tables and queries will then be the basis for the visualisation.



Figure 6: Sample Representation of the data model in PowerBI

## Feedback Loop

The senior leadership team and the supervisor were very keen on the KPI Process improvement, its outputs, results of visualisation the data and the automation of the process.

The company was in a rapid growth spurt as several contracts were won during 2022/2023 and a ramp up of activities were in progress. The direction was to use a feedback loop during the phased development process. Envisaged steps that was taken during the feedback loop:

1. Initial requirement meeting with suggestion by the supervisor of the visualisation of data.
2. Analyse, develop and display data as per the initial requirement.
3. Follow up meeting to determine if the result fit the expected requirements.
4. Publish any changes or improvements of the feedback received.

Step 3 and 4 would be repeated until decision to move to next visualisation feature. As the scope of the project and allocated time was controlled by the organisation supervisor’s priorities; it’s important to note that I had to adhere to my supervisor’s direction, which was fine and something to be expected of, when you work in SME environment, where priorities and work allocation change on a day-to-day basis.

## Technologies

The technologies used in the project were dictated by several limitations set by several factors. For example, the type of API used by Fieldview, scripting language/framework that could very efficiently and quickly generate data to PowerBI and any other technologies linked, researched, or discovered during the project development process. The key drivers for deciding the scripting language were the Fieldview API, SharePoint Online and how quickly and cost effective the solution could be put into productivity. There was no direction from the internal supervisor in relation to which technology was used.

### PowerBI

PowerBI is the tool to display dashboards of KPI views to the stakeholders of the organisation. Developed by Microsoft, PowerBI is an interactive data visualization software product (Microsoft, 2022). It is a collection of software services, apps, and connectors that work together to turn unrelated sources of data into coherent, visually immersive, and interactive insights. Data can be inputted/connected by reading directly from a database, webpage, or structured files such as spreadsheets, CSV, XML, and JSON.

### SOAP API

Fieldview uses SOAP API. SOAP is an acronym for Simple Object Access Protocol (AltexSoft, n.d.), which is a messaging protocol specification for exchanging structured information. I.E., allows for implementation of web services. Normally it uses XML Information Set for its message format, and relies on application layer protocols i.e., Hypertext Transfer Protocol (HTTP). It is worth noting Fieldview uses Hypertext Transfer Protocol Secure (HTTPS) for its API.

SOAP is over two decades old and allows users to pull or push data from a range of operating systems as well as numerous clients to run web services and receive responses over a range of script language and platforms.

### PowerShell

During the research process several scripting languages were considered for the project for example Node JS, PowerShell or Python.

PowerShell was selected as it was deemed it would cause the least amount of impact on any existing system or servers and could very easily be transferred between machines in the organisations IT environment. It has the potential of running future API requests inside the SharePoint Online Management Shell.

PowerShell is a command-line shell and scripting language (Sdwheeler, n.d.). It supports variables, functions, branching (if-then-else), loops (while do, for, and foreach) and structured error/exception handling and closures/lambda expression.

### Power Automate

Power Automate is part of Microsoft’s Power platform, which is a low-code application environment which allows for data analytics and workflow automation. This is where power automate will be used for the project, automating the flow of getting data from for example the Fieldview API to SharePoint Online.

Power Automate has 2 environments and both will be used in the project.

* The Power Automate Cloud Based service will be used to schedule Power Automate desktop tasks to run on a required basis (powerautomate.microsoft.com, n.d.).
* The Power Automate for desktops application will be installed and used to run PowerShell scripts. The scripting feature allows the user to run blocks of code in a couple of different languages, for example PowerShell, Python, VBScript and JavaScript (Georgiostrantzas, n.d.).

### DAX

DAX is a formula language used in Power Bi for data analysis. DAX is an acronym for Data Analysis Expressions. DAX allows the user to formulate formulas to perform queries and calculations on data in tables stored in Power BI (Minewiskan, n.d.).

Measures are an important component of Power BI and Dax. A measure is a dynamic calculated formula which results change depending on the content i.e., when the data was last refreshed. Measures are created by using the DAX formula bar in the model designer. (Minewiskan, n.d.).

A formula in a measure can use standard functions such as COUNT or SUM, or you can define your own formula by using the DAX formula bar. It’s worth noting that measures can be passed as an argument to other measures (Minewiskan, n.d.).

Graphical user interface, application

Description automatically generated

Figure 7:Sample View of DAX language in the formula bar of Power BI

# Project Plan

The milestones to achieve are outlined below.

|  |  |  |
| --- | --- | --- |
| **Milestone** | **Description** | **Due Date** |
| Draft Proposal | Initial project proposal and concept | 6th of November |
| Final Proposal | Articulate project nature and concept | 4th of December 2022 |
| Interim Report | Substantial update progress of the project | 12th of February 2023 |
| Final Project | Final project submission | 2nd  of April 2023 |

The project intended to span over the below phased development activities with preliminary due dates. It was anticipated that the dates and phases may be subject to change, due to a phase might take less or more time than expected as well as the allocated time and purpose of phase was controlled by the organisation supervisor’s priority.

|  |  |
| --- | --- |
| **Phase** | **Preliminary Sprint Due Dates** |
| Research & Training | 8th January 2023 |
| Data Connector setup – Smartsheet | 15th of January 2023 |
| FV API setup and Data Persistence | 29th of January 2023 |
| PowerBI Dashboard – Fieldview Vehicle-check | 12th of February 2023 |
| PowerBI Dashboard – Fieldview Form Count | 25th of February 2023 |
| PowerBI Dashboard – SmartSheet Timesheet | 19th of March 2023 |
| Automation of Data flows and Power BI Refresh | 26th of March 2023 |
| Project Wrap Up | 2nd April 2023 |

# Project Planner

The Microsoft Planner (www.microsoft.com, n.d.) tool was used for planning and execution of the project. In planner the user can divide development phases also knowns as sprints into buckets. Inside the buckets the user would then add tasks into it.



Figure 8: Microsoft Planner – Chart of Buckets



Figure 9:Microsoft Planner - Status of tasks and Buckets

# Implementation

## Phase 1: Research & Training

The phase of research and training covered three main areas.

**The Fieldview API.** The API Documentation of in the Viewpoint Help Section was investigated (Help.viewpoint.com, n.d.), contact was also made to the support desk of Trimble to get direction of how the API was structured. The research revealed the following.

Fieldview has 3 Data Centre API regions/URLs.

1. UK
2. North America
3. Australia New Zeeland

The organisations data is stored in the UK region data centre. Every Region has twelve APIs in two set of six different API (Help.viewpoint.com, n.d.). Grouped by XML or JSON, the APIs are:

* Configurations Services
* Forms Services
* Tasks Services
* Process Services
* Assets Services
* Project Services

2 APIs was explored for the purposes of the project.

* Configurations Services – this API allowed me to identify and call project ids and associated information. For Example, the projectID is required to get Form Information
* Forms Services – this API allowed me to get form information, and individual answers.

Below follows 3 images of the formsservices API GetQuestionAnswer() command, first the parameters, a view of the SOAP API and then the returned answer information

Table

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Figure 10:Sample of input Parameters

Graphical user interface, text, application, email

Description automatically generated

Figure 11: SOAP request and response

A picture containing table

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Figure 12:Returned information.

Time was spent understanding which API’s information had to be pulled, stored, and passed on to other API’s. One important feature noted in the research period was the API Call quota. The call quota is the number of points an API token can spend within a minute.

An API token in Fieldview has a maximum quota of 120 points allocated. This means you are limited to the number of calls that can be made per minute. For example, the GetProjectFormsList() has a point quota of 10, so this would mean that associated token to the API can only process 12 calls in one minute.



Figure 13:Call quota per API token

The research also showed that the Fieldview API would not easily return any data using the built-in data connectors in PowerBI and that the route of developing scripting of an API had to be taken. This is in line with the purpose of the project i.e., to showcase skills learned from the HDIP course.

It’s worth noting that there exist third party apps like ZappySys ODBC Power Pack, who integrate SOAP API with PowerBI. However, this not a free software and annual subscription is approx. $650 per desktop install (ZappySys, 2018).

**PowerBI.** To get an understanding of what capabilities PowerBI has and its functionality I signed up for Spanish Point Technologies “Dashboard in a day” course. Spanish Point Technologies is a software company and a Gold Certified Microsoft partner.

Spanish Point specialises in Azure, Microsoft 365, SharePoint, Dynamics 365, PowerApps & Power Automate, Power BI and SQL Server solutions (Technologies, n.d.). Company A has over the years used Spanish Point for various software solutions.

“Dashboard in a day” is a free full day workshop covering the capabilities of PowerBI through an instructor led online course.

* The goal of the course is to better understand how to:
* Connect to, import, and transform data from a variety of sources.
* Define business rules and KPIs.
* Explore data with powerful visualization tools.
* Build stunning reports.
* Share dashboards with their team and business partners and publish them to the web.

The power BI Bootcamp and training was completed on the 23rd of November 2022.

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Figure 14: Certificate of Completion

In addition to the above training, I also conducted various research online to find out how to do certain various items, anything from PowerShell Scripting to SharePoint Online solutions and Power BI queries.

## Phase 2: Smartsheet Data Connector setup

Smartsheet provides a Data Connector, which is part of PowerBI built in connectors.

Following steps were completed in this Phase.

1. Set up of user credentials in SmartSheet.
2. Ensure user had access to relevant tables in SmartSheet.
3. Connect Smartsheet to PowerBI using the built-in get Data feature in Power BI
4. Authenticate connection in PowerBI with Smartsheet user credentials.
5. Load and transform the relevant table from Smartsheet into PowerBI

Graphical user interface, application

Description automatically generated

Figure 15: Get Data view in PowerBI of Online Services

Graphical user interface, application, table

Description automatically generated

Figure 16:Preview of Connected Table ready to be loaded into PowerBI.

## Phase 3: FV API setup and Data Persistence

The focus of this phase was to be able to reliably pull information from the Fieldview API to the organisation’s hosted Data repository i.e., SharePoint Online.

The first thing I did was to generate API keys inside Fieldview, API key can be set on Group Organisation and Company level. A Company is a child of an Organisation. All keys were set up on Group Level.



Figure 17: View of Created API Tokens in Fieldview

The SOAP protocol does not have to have any readily available plugins and add-on and the SOAP API relies on discreet calls for every interaction with the host. These calls also need to be structured inside a SOAP API envelope. I needed to be able to use a scripting language compatible with SharePoint online and which has the capabilities to execute general programming tasks, for example for each loop and if statements.

By utilising PowerShell and its module New-WebServiceProxy I managed to achieve this. The PowerShell New-WebServiceProxy will download the API’s WSDL and use it to generate types for the proxy’s interface, data contracts and headers. PowerShell also allows you to import variables from a file and export variables to csv files. Tasks can then be scheduled to run at certain intervals, but this will be resolved in a later phase.

Text

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Figure 18: Code Snippet of the New-WebServiceProxy used to pull data from Fieldview.

The New-WebServiceProxy sets up a proxy object (Sdwheeler, n.d.), which allows for interaction with the Fieldview SOAP API and by utilising PowerShell capabilities of running foreach loops, if statements, I could connect and store all the project ids, and then loop them back into the next call which would in this phase retrieve form information. Every API Token has a call quota per minute (help.viewpoint.com, n.d.). Therefor I generated several API keys so I can generate multiple calls. I also added delays in the loop, to avoid exceeding the call quota.

Text

Description automatically generated

Figure 19:Code snippet of foreach loop with an if else statement

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Description automatically generated

Figure 20:Screenshot of Sample Data from the GetProjectFormsList( ) call.

### Data persistence

The main factor that decided which type of method for data persistence was going to be used in the project was availability and cost. The organisation has access to hosted servers but none of these are operational 24 hours a day, 7 days a week.

Increasing availability would lead to increased cost and for the data to be persistent it must write to non-volatile storage. Data persistence was achieved by saving the data to a file, after duplications were removed, it was then exported to Sharepoint Online (Rajack, 2018). By saving a file with the same name to the same location, SharePoint online just saves a new version of the file. A CSV file stored in SharePoint Online allows very easy connection to PowerBI by its built in Web connector.

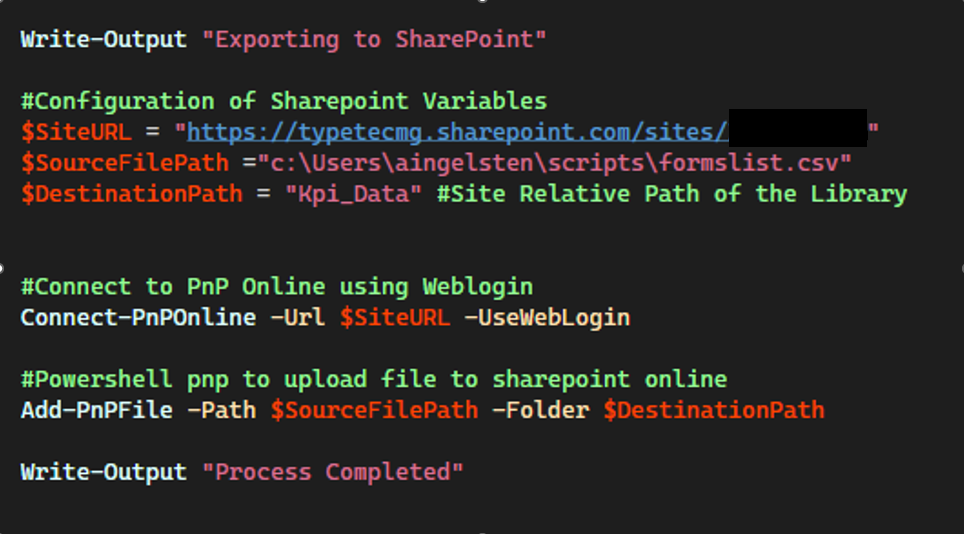


Figure 21:Sample Code of writing a file to Sharepoint Online

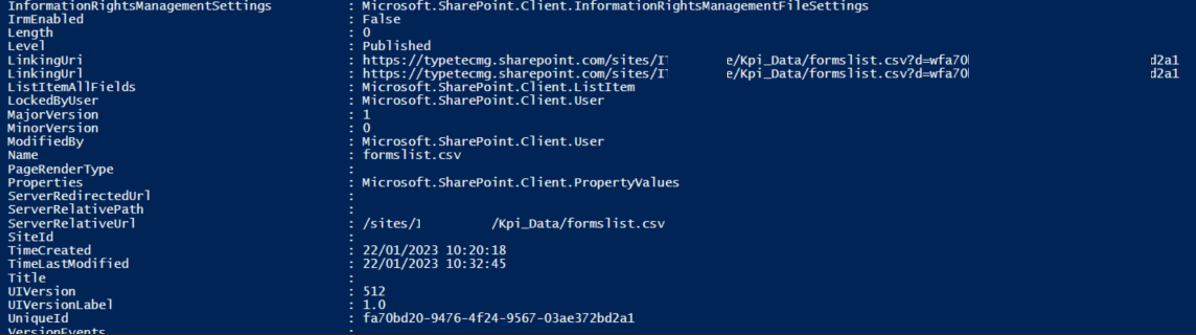


Figure 22:Screenshot of successfully writing the data to Sharepoint Online in PowerShell

## Phase 4: PowerBI Dashboard – Fieldview Vehicle-check

Phase 4 is the first phase that generated a Power BI dashboard result for the end company user. Employers who utilise company vehicles should have a process in place to conduct regular vehicle checks, to ensure that vehicles are in good order and safe to use (Health and Safety Authority, n.d.).

Company has a fleet of 44 vehicles and every user of a vehicle are required to do a weekly vehicle check. The requirement from the Plant Manager was to get a count of completed forms per week and division.

For this purpose, I utilised the GetProjectFormsList API call, which gets all forms per project and timeframe. As company A have multiple projects in Fieldview I had to loop the API call through all Projects and also do an if statement as not all projects will have Fieldview forms in them during the timeframe requested

Text

Description automatically generated

Figure 23: Code of File export Sample

Data generated via the API call is then appended to a CSV file, which is checked and cleaned for duplication and then exported to SharePoint Online.

A screenshot of a computer

Description automatically generated

Figure 24: Export to SharePoint with automated details

I added the SharePoint data into PowerBI by using the Get Data Web function which takes the SharePoint URL of the CSV file. When the file is updated in SharePoint I can refresh the data in PowerBI by utilising the refresh function.



Figure 25: Form data as exported from FV.

I analysed the imported data and to create the desired out come I created a Measure in DAX scripting that provides a count per form name, weeknumber, location and status like below. In this case the form is called “Company Vehicle Check List”. It is worth noting I had to use the IF(ISBLANK) feature to avoid the card displaying the value “BLANK” (Rad, 2020).

Graphical user interface, text, application

Description automatically generated

Figure 26: DAX code of Count

Calendar

Description automatically generated

Figure 27: View of Counts

I then used the vizulisation tools in PowerBI to create the following Report Dashboard, count of active vehicles and completed vehicle check list forms, and an additional view that shows the count of check lists per week in a table diagram.

The next task for this phase was to make it visible for the end user through the Company’s SharePoint Intranet. I had 2 options.

* Publish an Embed Link in SharePoint – this requires every individual user to have a PowerBI license.
* Or to generate Embedded Html code, so it can be published to multi users.

Graphical user interface, text, application

Description automatically generated

Figure 28: View of Embed Link

I choose the latter, which required me to purchase PowerBI Pro license and I had to make sure the default admin settings allowed the user to create embedded code creation.

Graphical user interface, application

Description automatically generated

Figure 29:View of admin message

Graphical user interface, text, application

Description automatically generated

Figure 30: View of embed code view.

The embedded code was then published in SharePoint using the Embed code function.

Text

Description automatically generated

Figure 31: View of Sharepoint Online Embed function.

End result of the published view embedded in the Plant Transport page.

Graphical user interface, website

Description automatically generated

Figure 32: View of Sharepoint Intranet

Phase 5: PowerBI Dashboard – Pipedrive

At the project planning phase, I planned after the vehicle check phase to develop a dashboard that would display form counts per project. An active project has several forms that are required to be filled in on a regular basis, for example, daily site diary’s, weekly project reports, monthly safety audits etc.

However, the commercial team requested that I would instead create a dashboard which would display the current business development pipeline. Displaying a summarised contract value per quarter start period.

Pipedrive is a CRM (Customer Relation Management) system that allows the user to track business development, e.g., potential leads, their value and tracking interactions like phone calls and meetings (Pipedrive Inc / Pipedrive OÜ, 2018).

I therefore investigated the Pipedrive application and its API capabilities. I found the Pipedrive API documentation (developers.pipedrive.com, n.d.) and a GIT repository in relation to using PowerShell (Seidlm, 2021), connecting and retrieving data from the Pipedrive API. Effectively using PowerShell’s Invoke-RestMethod which sends HTTP and HTTPS requests to Representational State Transfer (REST) web services which then returns data in a rich and structured format (sdwheeler, n.d.).

Together with the Business Development manager we added a custom contract start date and data was entered so the report could be generated in Power BI.



Figure 33: Code snippet of Pipedrive script

After that I created a PowerShell script that pulled all deals, activities and persons. Due to the data being paginated I had to do a loop to retrieve all data.

The data was then exported to Sharepoint online, imported to PowerBI and relationship setup between the 3 tables.

Graphical user interface, application

Description automatically generated.

Figure 34: View of table relationships

From this position I generated a report in Power BI that displays the contract value of open tenders with expected quarterly start dates as per below. Note data has been redacted due to they being commerically sensitive.

Chart, bar chart

Description automatically generatedAs an added bonus I also generated a report of the logged activities conducted by the business development manager since the inception of Pipedrive

Figure 35: View of Values per Quarter

Chart

Description automatically generatedThe data for the Pipedrive views must at a minimum be updated monthly as per the KPI dates.

Figure 36: Report view of logged activities

## Phase 6: PowerBI Dashboard – SmartSheet Timesheet

Upon completion of the Pipedrive dashboard, my company supervisor asked me to prioritise a dashboard that displayed a summarised view of hours allocated per contract by user. Utilising the Smartsheet connector as rolled out during Phase 2, I could import the Timesheet table for office staff.



Figure 37: View of Smartsheet timesheet table

After that I generated a Donut chart of the summary of hours per contract. I also generated a corresponding table view and a card of the total sum of contracts. View have been blurred to hide data. Graphical user interface, application

Description automatically generated

Figure 38: View published on Company Intranet

As per requirements from the company supervisor, the visual can be drilled down to contract, section code and employee level.

Chart

Description automatically generated

Figure 39: Drill down view Timesheet

## Phase 7: PowerBI Dashboard – Fieldview Timesheet

The next priority set by the company supervisor was to create a dashboard which displayed a summarized view of hours generated by site staff using the Fieldview application.

For this I had to use a different Fieldview API called GetQuestionAnswer. This API takes in the APItoken, FormID and the QuestionAlias and provides the answer and meta data of the answer.

The minimum required data was employee name, contract, date, and hours, so I had to create four get requests and due to the API has an API quota of 10I quickly realised to run an effective query I had to generate an API Token per API call.



Figure 40: Code Snippet of 4 answer queries

Text

Description automatically generated

Figure 41: Code snippet of API call

From here I ensured the script generated four CSV files, one per answer and the script exported the files into SharePoint Online.



Figure 42: Code snippet of export to SharePoint

After the 4 answers from Fieldview had been imported into PowerBI, all the 4 tables were joined by their common identifier: the FormID.

After analysing the data and outputs I noticed an issue in relation to amount of generated answer data for the question date. The query generated an answer for every form that has a question alias with the word “date”. Note there are currently over 120 active forms in the Fieldview system. After realising this, I renamed the Timesheet alias in Fieldview to "TS\_Date\_Timesheet". As a precaution I also updated the aliases for the other three questions. This resolved the issue.

To be able to generate the required visualisations, I proceeded to use the PowerBI modelling tool where I created a User/Contract table, a Date/Hours table and from these tables I generated a combined Timesheet table that allowed me to generate the visualisation.

Graphical user interface, application

Description automatically generated

Figure 43: Query view in PowerBI

See view below of all the Fieldview table and their relationships in PowerBI.

Graphical user interface, application, Word

Description automatically generated

Figure 44: Table relationships in PowerBI

The visualisation requested is the following, a card with total summary of all hours, a donut chart displaying the breakdown of summarised hours per contact and a stacked column chart per employee. The views allow for drill down per person.



Figure 45: Summary visualisation of the hours per contract and user

Chart, bar chart

Description automatically generated

Figure 46: Drill down view per contract, month, and person.

## Phase 8: PowerBI Dashboard – Asset Manager

This phase was added, as I was asked by the Company’s project supervisor to investigate if I could connect Asset Manager and display’s KPI report visualisations for the company’s plant manager.

Asset Manager is a 3rd party software developed by Kaizen Software Solutions and is utilised by the company to track all fixed and plant assets (Www.kzsoftware.com, n.d.). The system holds asset details, value but also service and certification records. The plant manager needed to be able to access upcoming service and certifications renewal dates more easily as part of his KPI requirements.

The Asset Manager backend database is of type Firebird. It is an open-source SQL relational database management system that supports Linux, Microsoft Windows, macOS and other Unix platforms Home. (n.d.).

PowerBI has no built in connector to Asset Manager, but after a bit of research I found a software company called Devart who provides an ODBC driver that allows Power BI to connect to Firebird via ODBC (Docs.devart.com, n.d.).

I then progressed and installed the driver, and configured the connection, and used the Power BI ODBC connection to bring in the information, see screenshot samples below.

Graphical user interface

Description automatically generated

Figure 47: View of Devart Configuration

Graphical user interface, text, application, email

Description automatically generated

Figure 48:View of connected Data Source

Graphical user interface, application, table

Description automatically generated

Figure 49: View of Tables available from Asset Manager.

From here I brought in the Servicesheduled table. After analysing the data, I noticed that the table has every service record done for every plant item. The unique identifier for data is the Service ID. To be able to provide a view of upcoming service dates for the plant manager, I generated a DAX query table of the latest Service ID per plant item. From here I then did a join with the existing table and could then generate the relevant views, see screenshots below.

Graphical user interface, application

Description automatically generated

Figure 50: Query of the latest service ID



Figure 51:Table query of the latest service ID

Graphical user interface, application

Description automatically generated

Figure 52:View of the joined table relationship.

The visualization displayed a stacked column table with upcoming plant items, and by utilising the drill down the user can see a list of the Plant items to be serviced per quarter.

Table

Description automatically generated

Figure 53:View of asset types and corresponding table.

## Phase 9: Automation of Data flows and Power BI Refresh

The company supervisor required the data to be updated automatically, up to this point in the project I had run all data refresh manually. For this I decided to use two separate tools, the Task Scheduler and Power Automate.

### Task Scheduler - Webserver

The Asset Manager database is situated on the Company’s web server. The web server is only available from 08.00 to 1800 Monday to Friday. So, for the process of an automated copy, I wrote PowerShell copy script as per below.

Text

Description automatically generated

Figure 54: Code snippet of copy code

The next thing I did was to open Task Scheduler and create a scheduled task which starts PowerShell and runs the above scripts. Inspiration for this was found from the Spiceworks website (Inc, n.d.).

Graphical user interface, text, email

Description automatically generated

Figure 55: View of Task Scheduler setup to run script every 15 min.

Graphical user interface, text, application

Description automatically generated

Figure 56: View of Scheduled copy task in situ with running history

I updated data in Asset Manager, waited an appropriate amount of time (30min) and refreshed PowerBI to ensure this process was working.

### Power Automate – Domain Controller Server

I then moved on to automate the PipeDrive and Fieldview API scripts. For this I decided to use Power Automate and to use the Domain Controller server, as it is on 24/7. The first thing I did was to change the scripts so they can run on the Domain Controller environment. The second thing was to do a test run of the scripts. I could see the data being updated locally but the data would not update in SharePoint. The error log showed the following “error Connect-PnPOnline: The term 'Connect-PnPOnline' is not recognized as the name of a cmdlet”. I researched the error and by running the “Install-Module SharePointPnPPowerShellOnline” in PowerShell the issue was resolved.

The method used, using PowerShell script with Power Automate, was the following:

* Install Power Automate Desktop on the device where I want to run the script.
* Create a flow with Power Automate Desktop
  1. Add the PowerShell module to the flow.
  2. Copy and paste the script into the PowerShell module.
* Create a cloud flow with PowerShell Online
  1. Add a Re-occurrence task.
  2. Add a Run a Power Automate Desktop flow.
  3. Save and run the flow in “Unattended Mode”.

A prerequisite to this is you have to login with the same Microsoft User account for both Power Automate Desktop and Power Automate Cloud. Below follows screenshots of the process.

Graphical user interface, application

Description automatically generated

Figure 57: Installation of Power Automate desktop on domain controller server.

Graphical user interface, application

Description automatically generated

Figure 58: Before implementation of flows

Graphical user interface, text, application

Description automatically generated

Figure 59: Creating the Run PowerShell Script on Power Automate Desktop

Graphical user interface, text, application

Description automatically generated

Figure 60: Adding the script to run in the Flow.

Graphical user interface, text, email

Description automatically generated

Figure 61: View of all the 5 PowerShell scripts that was setup on the Power Automate desktop.

Graphical user interface, text, application, email

Description automatically generated

Figure 62: Recurrence step on the Power Automate Cloud

Graphical user interface, text, application, email

Description automatically generated

Figure 63: Running the Power Automate desktop flow on the Power Automate Cloud

Graphical user interface, text, application, email

Description automatically generated

Figure 64: Connection used for cloud hosted servers to run the PowerShell scripts.

Graphical user interface, application

Description automatically generated

Figure 65: Sample of a flow -this running multiple scripts

Graphical user interface, text

Description automatically generated with medium confidence

Figure 66:Summary view of the cloud flows

### Power Automate – Domain Server - Reverting to Task Scheduler

After I completed the flows, I started generating some test data and monitoring if real data was updated to the SharePoint online stored files. Initial results were fine, and I left the process run for approx. 24 hours. Reviewing the flows and the data after 24 hours I noticed that the data had not been updated and that all flows were failing. By reviewing the fault message in Power Automate the errors were due to a user who was logged into the machine and the flows would not run when the machine was attended.

Since the Domain Controller is a Server that may be accessed by several users i.e., Sys Admins who may not log off from the machine etc, I had to change the method used for this process. I decided to utilise Task Scheduler instead as it will run regardless of user is on the machine or not. Below follows screenshots of the error discovery process and the rectifying of the issue.

All initial ran fineGraphical user interface, text, application

Description automatically generated

Figure 67: Initial setup with run history

Graphical user interface

Description automatically generated

Figure 68: Successful runs of flows

Table

Description automatically generated

Figure 69: View of several failed flows

Graphical user interface, application

Description automatically generated

Figure 70: Detailed view of a failed flow

Text

Description automatically generated

Figure 71: Detailed flow error message

Graphical user interface, text, application, email, Teams

Description automatically generated

Figure 72: Turning off all the Cloud Flows

Graphical user interface, text, application, email

Description automatically generated

Figure 73: Setting up the Task Scheduler

I decided to have individual tasks per script so I if/when I need to update/fix a script I won’t impact the rest of the updates. To speed up this process I used the export and import function available in Task Scheduler. The task is export to XML, and this is also the format for importing the task then I updated the schedule and arguments i.e., which script

A picture containing text

Description automatically generated

Figure 74: Sample view of the export/import XML file of a task

Graphical user interface, text, application, email

Description automatically generated

Figure 75: Summary view of the 5 PowerShell scripts in the Task Scheduler

### PowerBI – Automated Refresh and Publish

After I had automated the running of the scripts the next requirement to fulfil was the automation of the PowerBI dataset and views. PowerBI has 2 interfaces, the desktop version and the online version. After researching the matter, the method suitable for the project was to schedule the refresh using functionality in the online version (Davidiseminger, n.d.).

The following was executed, I identified the datasets, installed and configured an on-premises data gateway on my company domain joined laptop to ensure connectivity between the PowerBI and the data sets. OAuth2 was used as the authentication method and privacy level was set to organizational. The refresh was set to happen during weekdays between business hours. Below follows screenshots of the process.

Graphical user interface, text, application, email

Description automatically generated

Figure 76: PowerBI Datasets view for automated updates.

Graphical user interface, text, application, email

Description automatically generated

Figure 77:On-Premises data gateway

Graphical user interface, text, application

Description automatically generated

Figure 78: Gateway connected.

Graphical user interface, text, application

Description automatically generated

Figure 79:Authentication of data sources

Graphical user interface, text, application

Description automatically generated

Figure 80: Scheduled refresh view

Table

Description automatically generated with medium confidence

Figure 81: Refresh History

The implementation of the refresh was successful, and all my PowerBI dashboards updated successfully as per set schedule. One minor thing I noticed was that the refresh doesn’t run exactly on the set time, my assumption here is that they are queued in the Microsoft cloud thus the 5–8-minute delay.

A while after I had implemented the phase I had to go to site to assist with a printing issue, this meant i had to bring my laptop with me. During the call out I received an email with an error notification, see below.

Text, letter

Description automatically generated

Figure 82:PowerBI refresh error.

After analysing the error, this line “*Unable to complete network request to host \"wsa005a\".\rFailed to locate host machine*” had the key to the answer – the issue was due to the laptop not being connected to the Company’s domain - the data gateway could not connect to webserver “wsa005a “. I connected to the domain using the company’s VPN client, SonicWALL Netextender, and I could then run a successful PowerBI data refresh.

Graphical user interface

Description automatically generated with medium confidence

Figure 83: SonicWALL Netextender.

# Project Evaluation

## Achievements

With the project I believe I achieved the objectives and solved the two main problems I set out to resolve.

Objectives achieved and problems solved.

* Ease of access; a greater number of staff can now see the information published in dashboard on the company’s intranet.
* Real-time information: users are not waiting days to view the data.
* Process improvement: less time spent by staff to collect and produce reports.
* Less manual input of data and time spent on this process.

## Knowledge attained.

I found that the subject matter within this project was natural extensions of the topics covered in the different modules of the Higher Diploma in Computer Science. More importantly it provided me a base from where I have the confidence to do research and apply solutions suitable for the project. Also allowed me to more easily see and resolve errors. To summarize the project has provided the knowledge and skills to

* Setup, generate and publish report views in PowerBI.
* Pull in data sets and model their relationships by common identifiers.
* Use built in as well as 3rd party connectors in PowerBI.
* Use PowerShell to pull data over API’s.
* Use DAX formulae language to create bespoke data columns and measures in PowerBI.
* Automating the running of PowerShell scripts and PowerBI data sets.
* Project Manage an internal IT project from start to finish.
* Gather company requirements, research, and implement solutions for the same.
* Communication and leadership skills in a project manager capacity
* Greater knowledge of PowerBI and its limitations as well as possibilities.

## Future Learning

I have identified I need further education and self-development in the following areas.

* The PowerBI platform and its Data Queries
* DAX scripting language
* Sharepoint online management shell
* Microsoft Data verse business layer

## Future Development Work

I can foresee the following future development work in relation to the projects. I have categorised them into three categories.

### Review of the current state

As the data and requests will grow, I anticipate iteration and tweaking of PowerShell scripts, review of the task scheduler refresh schedule, and the PowerBI refresh schedule, view changes in PowerBI and Dax scripts updates. My assumption is that this is something that I will be continuously looking at in my role at the company.

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Figure 85: Change of Task Scheduler

Graphical user interface, text, application, Word

Description automatically generated

Figure 86: DAX formula to resolve weighted monthly value.

Chart, bar chart

Description automatically generated

Figure 87:PowerBI view of weighted monthly value

### Adding more data sources

As the project is established in the Company, I anticipate I will be asked to gather more data sources and publish more business data analytics for stakeholders within the company. This was made explicitly clear to me when during one of our regular project meetings my supervisor turned to me and said: *“Best thing you can do now, is to shut up and not to tell anyone else about this and remember look after our team first”.*

The meaning of this was twofold, one was not allowing the project scope to creep, and secondly if I would have allowed the rest of the organisation know of the capabilities we had in hand, there was a chance I would get inundated with data query request from all parts of the organisation.

Company A is in the utilities/construction business. It would be of great value for a project manager, contract manager or the commercial team to know the real progress of a project, for example a duct excavation on target as per the project plan. Below follows a typical request received during the project development process by a site manager.

*“Hi Anders,*

*Not sure if it’s possible, maybe it’s there,  I was wondering if it were possible to create a Table on View Point where a person could just fill in a Tab showing a Weekly Progress Report say on the Meterage of Grid Duct Trenching / Installation, that may run an excel file in the background which would show for instance the agreed amount per week which is a fixed point & the other the actual, Or do we have something else set up, as it would be great to track, say cable installed, joints made off etc”*

Chart, line chart

Description automatically generated

Figure 88: Sample of requested view 1

Chart, line chart

Description automatically generated

Figure 89: Sample of requested view 2

### Long Term future functionality

in relation to Data persistence storing data as CSV files in SharePoint online might be a solution for the immediate future. Overtime other solutions will be reviewed, for example SharePoint Lists, MS Dataverse and Azure SQL Database can possibly be in scope. In addition, adding systems that have not yet considered to be the power BI platform. For example, the Company’s ERP system and the HR management system.

## Conclusion

The initial review of the first iteration of a published dashboard of real company timesheet data to the company’s CFO went beyond my expectations. The person’s eyes lit up, the penny had dropped, the feedback was immensely positive and new requirements were expressed immediately*. “Can we show this per month per person instead, and what about this, can we compare with previous month?!”.*

From a personal view, on many occasions during this project several thoughts kept re-occurring, these self-reflecting thoughts spanned across various emotions but to highlight the most descriptive ones:

*“I couldn’t have done this 2 years ago”.*

*“It works! - look at all that data coming in”.*

*“Is this right? Is the tool and methods I used, correct and stable?”*

Being the sole responsible person for the project, (the company supervisor provided no direction in relation to preferred techniques or methods), I had to look at the surrounding conditions, environment, and cost, then decide and proceed down a chosen path, deal with problems encountered and solve them on the go. This is where I believe I have learned the most and where the acquired knowledge from the course assisted me in the best practise.

Furthermore, the expression “garbage in, garbage out” was very relevant in this project. Both from the perspective of understanding the data and that the reports displayed in Power BI were true. To also seeing samples of uncomplete and erroneous data and how to apply the appropriate business logic. It’s worth noting that in Fieldview you cannot delete data, it is only labelled deleted with a flag of True or False.

In the end, I enjoyed the whole process of exploration, research, implementation and mostly seeing the result which is now benefiting the reporting process of the Company.

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