Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.

Network Licensees must publish the required Project Progress information on the Smarter Networks Portal by 31st July 2014 and each year thereafter. The Network Licensee(s) must publish Project Progress information for each NIA Project that has developed new learning in the preceding relevant year.

NIA Project Annual Progress Report Document

Date of Submission

Jun 2022

Project Reference

NIA_WPD_053

Project Progress

Project Title

Network Event and Alarm Transparency (NEAT)

Project Reference

NIA_WPD_053

Funding Licensee(s)

WPD - Western Power Distribution (East Midlands) Plc

Project Start Date

October 2020

Project Duration

2 years and 1 month

Nominated Project Contact(s)

Jenny Woodruff

Scope

The investigation will consider how the alarms in the new ANM and SVO systems relate to the alarms within PowerOn or to each other. However, the approach taken and prototypes developed will be generalised as far as possible so that it could be applied to future systems yet to be developed, or systems in use by other DNOs.

The analysis will result in rules or information that can be used to understand root causes for alarms and events allowing the system support staff to take steps to reduce their frequency.

For the avoidance of doubt, the existing alarm and event management facilities within PowerOn already provide a number of features to simplify and prioritise the information provided to the control engineers and the project does not intend to duplicate these.

The project approach will contain six distinct work packages:

WP1. Specification Gather detailed business domain knowledge to ensure a solid understanding of the WPD network region, business processes and availability of data.

WP2. Design This work package will look into the design of the NEAT platform through a data quality assessment, data analysis and identification of advanced analytical techniques. This will cover checking the data is complete and whole, identification of outliers or other logical inconsistencies and ensuring that the joining of datasets does not lose information or incur further data issues. An initial phase of data analysis will be used to derive preliminary insights and observations. This may involve the use of statistical

models but primarily aims to identify characteristics of the data set and inform the formal modelling task.

WP3. Build During the build phase the advanced analytical techniques and dashboard development will be completed. Depending on the insights identified during the initial data analysis during the design phase these may include; clustering analysis, network association analysis, spatial analysis where geographical information is present, time series analysis, and predictive forecasts. The analytical techniques will be integrated into the NEAT dashboard and will also include the development of stage that load data from the databases into the analytic tool to be formalised and available to run on a regular basis.

WP4. Deploy and Test Selection and integration of the project into the NEAT dashboard. This stage also requires the scripts that load data from the databases into the analytic tool to be formalised and available to run on a regular basis as well as user acceptance testing.

WP5. System Trial & Analysis The prototype dashboard will undergo further development during a live system trial to extract insights from the alarm and event analysis. This will include reviewing trends during the trial period to look for results improvement and learnings.

WP6. Dissemination and Closedown Report This will cover the findings in terms of alarm relationships as well as trends from the ANM and SVO alarm systems. This will highlight the benefits and improvements possible through better understanding of the interactions between different events and improving the analysis from control room operators.

Objectives

The objective of the project are to;

- Understand the data that can be used to provide context for the alarm and event analysis.
- Assess the quality of this data and where possible correct quality issues.
- Derive preliminary insights from the data to inform the selection of models.
- Carry out advanced analytics to understand the relationships between alarms and events in different systems and the external datasets.
- Create a prototype dashboard to allow the analysis to be run regularly and present the user with results.
- Trial the use of the dashboard using real data over a period of time.
- Consolidate and share the learning from the project.

Success Criteria

The success of the project would be indicated by the following outcomes.

- The project has gained an understanding of the new types of alarms and events associated with new systems supporting DSO functions, how these differ from “traditional” control system alarms and how the needs for their management differ to traditional alarms and events.
- The data sources that are available to contextualise these alarms have been explored and relationships between data items and the alarms and events have been found.
- The learning gained from analysing relationships between alarms and events and the contextualising data has been incorporated into a dashboard which is suitably generic in design to facilitate future systems to support DSO functions that are not yet known.
- A dashboard to assist with the management of these alarms and events has been developed and tested. Learning from the trial has been used to recommend changes to datasets, processes, systems etc. to reduce alarms and events in the future and/or the way in which alarms and events are managed has been improved to reduce the time spent on their management.

Performance Compared to the Original Project Aims, Objectives and Success Criteria

The project, which has completed the Specification phase and is nearing completion of the Design phase, is meeting its objectives as follows:

· understand the data that can be used to provide context for the alarm and event analysis

o Complete - Several extracts of WPD data have been provided for assessment including data from the control room system PowerOn, SVO alarms, ANM data, the Integrated Network Model and extracts from the Asset Management System CROWN.

Exploratory data analysis has taken place and has been documented in a Data Quality Assessment Summary

· assess the quality of this data and where possible correct quality issues

o Complete - A Data Quality Assessment Summary document has been produced. Some data quality issues have been corrected, e.g. where data exports included some records which had been reported in the wrong fields.

· derive preliminary insights from the data to inform the selection of models

o Complete - Different modelling techniques have been applied such as event flood detection, temporal pattern identification, outlier assessments, clustering, use of word clouds etc.

· carry out advanced analytics to understand the relationships between alarms and events in different systems and the external datasets

o Complete - Initial modelling and additional modelling during the build phase of the project have taken place. These have been able to identify patterns in the data such as daily testing of telecoms equipment which generates alarms and to understand the types of alarms generated for typical network faults.

· create a prototype dashboard to allow the analysis to be run regularly and present the user with results

o Complete - The prototype dashboard has been specified in the System Design Document and has been developed and is ready to install on WPD's server.

· trial the use of the dashboard using real data over a period of time

Ongoing - This part of the project has been affected by delays due to issues in configuring two new technical elements required to set up the NEAT system within WPD, CyberArk, and OpenShift, as well as COVID related absences and issues with configuring the VPN.

· consolidate and share the learning from the project

o Ongoing - This will take place after the Trial phase of the project

The project is meeting its success criteria as follows:

· The project has gained an understanding of the new types of alarms and events associated with new systems supporting DSO functions, how these differ from "traditional" control system alarms and how the needs for their management differ to traditional alarms and events.

o Achieved - The project has identified that the different alarms within the ANM and SVO systems reflect the additional functions of state estimation and real-time power flow analysis. Many of the new alarms reflect the performance of these elements which can be affected by the network models being used not reflecting the real network or its configuration such as can occur following model updates, failure of telecoms systems, or failure to replicate real-time network reconfiguration. Further work has taken place to enable a greater range of ANM related messages to be passed to the PowerOn system so that they can be passed on to NEAT.

· The data sources that are available to contextualise these alarms have been explored and relationships between data items and the alarms and events have been found.

o Achieved - To provide context for the PowerOn alarms, data extracts have been provided from the CROWN system that would indicate maintenance work or other work which might result in local alarms. The Integrated Network Model has been provided which links our key systems for asset management (CROWN), network control (PowerOn) and GIS (Electric Office). Historical Analog data was also investigated from two different sources as well as network hierarchy information from the network capacity map and switching information from the PowerOn system via our Webfocus reporting application. Relationships between network switching and PowerOn events are the clearest especially as many events start with the operation of a circuit breaker or other protective device.

· The learning gained from analysing relationships between alarms and events and the contextualising data has been incorporated into a dashboard which is suitably generic in design to facilitate future systems to support DSO functions that are not yet known.

o Achieved - The relationships inform the models that sit behind the dashboard. The dashboard contains different ways to view existing events, past performance and an assessment of the current risk level for SVO and ANM systems.

· A dashboard to assist with the management of these alarms and events has been developed and tested. Learning from the trial has been used to recommend changes to datasets, processes, systems etc. to reduce alarms and events in the future and/or the way in which alarms and events are managed has been improved to reduce the time spent on their management.

o Ongoing - While the dashboard has been developed, this has not yet been tested due to the delays to the trial from the technical and staff availability issues. The trial is expected to take place once the issues with OpenShift are resolved which will allow the learning from use of the system and subsequent recommendations.

Required Modifications to the Planned Approach During the Course of the Project

Some items within the project plan have been rescheduled to reflect the availability of alarm data, which has taken longer to provide than expected. The delays reflect the discovery of an extraordinarily high volume of alarms for the time-period being assessed which prevented the normal extraction process being used. Determining and executing an alternative method introduced considerable delay, however it is believed that the insights gained from analysing this unusual event will be beneficial.

Similarly some data extracts included staff names which was not expected. There was some delay due to the need to agree and apply redaction techniques.

The approach to be taken during the trial was revised as the SVO system has been decommissioned and therefore live operational data can no longer be used for the trial. This follows a change in approach for SVO roll out into Business as Usual which will see the SVO system functionality rebuilt within PowerOn. The trial will use historical data from the previous year and match this with extracts from the other systems that are contemporary to the SVO operational data.

Some additional modifications to the data import were required due to concerns over producing very large exports overnight in an unmonitored process.

The trial phase of the project has been delayed following multiple technical issues affecting the VPN, CyberArk and OpenShift required to configure the NEAT system on the WPD server and issues with staff availability due to widespread COVID infections.

Significant changes have been managed using the change request process as part of the project governance arrangements.

Lessons Learnt for Future Projects

The lessons learned in the first year of the project mostly related to the Data Quality Analysis that has been undertaken. This concluded that the data quality should be sufficient to support the complex modelling intended for the project. The report also concluded that linking our datasets together had been more difficult than expected and that information to map between systems was difficult to obtain. WPD has recently been building on the work from the Presumed Open Data project to create data dictionaries that can be shared. These should reduce the time taken to map between systems in the future. The analysis confirmed that there was a cyclical nature for events reflecting the working week and the hours of the working day.

Harmonic was able to identify several alarm floods and cluster alarm floods into unique clusters, each with a unique alarm profile. Alarms that occur before an alarm flood were also able to be identified, and the preliminary results show that precursor alarms tend to be unique for each alarm flood cluster. This leads us to believe that alarm floods, and alarm flood clustering techniques, can be used to identify patterns among PowerOn alarms.

The issue of unexpected staff names appearing in alarm data may be relevant to other projects. Names were found to be not only included in separate, easily identifiable fields but embedded within the text of alarm messages which required a multi-stage redaction process to resolve.

Unexpected delays in obtaining information resulted from a very large number of alarms being recorded within the PowerOn system that reflected an unusual issue affecting a small number of devices on the network. Interference from systems such as mobile traffic lights can result in the device not receiving confirmation that an alarm has been received and resending the same alarm repeatedly. The number of duplicate alarms was so large as to increase the data volumes beyond the capacity of the normal means of exporting the data.

Future projects should allow some contingency within project plan timescales for managing unexpected actions for GDPR compliance and also for routine data extraction.

More recent learning has reflected the difficulty of operating without a full data dictionary for the various data extracts. There was also a limitation in the data that could be extracted for changes in the network that were reflected in network patches as it was not possible to simply identify the assets that were altered and once identified these resulted in duplicated data which extended data upload times. The difference in network IDs used in HISTAN files and Time Series Data Store (TSDS) records and network assets recorded in PowerOn meant that records had to be matched manually which was time consuming. Issues with standard reports giving time in 12 hour rather than 24 hour format were also discovered and corrected.

The switch off of the SVO system reflected the difference in priorities of different parts of the business which can change during the course of an innovation project and highlighted the need for projects to allow for unexpected changes.

The difficulties in setting up the VPN initially reflected that the various responsibilities of the different WPD IR teams are not easily co-ordinated by a third party. This issue has been recognised and new IR project manager roles are being implemented to provide the element of co-ordination and expertise that is required.

Technical learning included the need to specify specific web-browsers as the default browsers for WPD and Harmonic were different and different behaviour was observed when trying to access the same secure site. Similarly, the need for devices being used for two-factor authorisation to have a correct time-signal was found when a phone set to the wrong time by around six minutes was found to underlie the failure of an authentication process.

We also learned that while e-mail exchanges rather than face to face meetings are more convenient for teams working with a 13 hour time difference, greater progress would normally result from using face to face meetings when investigating technical issues.

The system trial is expected to generate much of the learning for the project on the effectiveness of the NEAT system and the degree to which the information can be used to improve system reliability.

Note: The following sections are only required for those projects which have been completed since 1st April 2013, or since the previous Project Progress information was reported.

The Outcomes of the Project

This project is yet to carry out the trial which is expected to generate the main learning for the project.
To date the project has delivered a System Specification Document, a Data Quality Assessment Summary a System Design Document, a System Build document an a User Acceptance Testing book.

The process has uncovered previously unknown issues with how the data was being recorded within PowerOn and issues with the way in which data was presented in standardised reports. It has confirmed the value of data dictionaries (which WPD are currently compiling) and of having specialist project management assistance within WPD Information Resources (IR) where there is a need for co-ordination between many IR teams.

It was expected that the tool would have been delivered, tested and that the trial phase would have begun however this has been delayed due to problems with using two new technologies within WPD that have proven to be more difficult to install and use than was anticipated. The installation problems have been exacerbated by changes to key members of staff and large numbers of staff being unavailable due to covid infections. Once the trial takes place it will provide insights about how well the models can identify patterns in historic and real-time data and the best way to present the information to the user, the practicalities of running the system e.g. whether

the data items and data provision frequencies are appropriate and how the benefits in practice compare with expectations.

Data Access

No new data was captured by the project. The representation of the network model used by the project, the Integrated Network Model, is available via our Energy Data Hub available here, https://www.westernpower.co.uk/our-network/energy-data-hub

Foreground IPR

The foreground IPR that has been developed to date is captured in the draft System Design Document. The default IPR arrangements apply.